The Social and Economic Impact of Child Undernutrition in Sudan

THE COST OF HUNGER IN AFRICA

COHA

SOCIAL AND ECONOMIC IMPACT OF CHILD UNDERNUTRITION

SUDAN

Financial Support by:

The Social and Economic Impact of Child Undernutrition in Sudan

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Foreword

The Sudan Cost of Hunger in Africa (COHA) Report

The Sudan Transition Government puts in places a high level of aspiration and commitments towards the agenda of welfare and sustainable development of Sudanese's people and foremost young generations and children. They are the key pillar of the bright future of the country and the better response to their current needs would contribute significantly to the overall social and economic development of the country.

Over the past decades, Sudan has faced a series of shocks that have triggered a decline in food security and nutrition trends. The country has suffered from long lasting civil war, tribal conflicts, natural disasters; floods, drought, and overall poor governance. Alongside growing poverty and food insecurity, stunting rates due to undernutrition among children under five continued to report high records, accompanied by the growing double burden rates of infectious and non-infectious diseases trends. Undernutrition and related chronic diseases, such as non-communicable diseases that follow later in life, created a vicious circle that poses a fundamental challenge to policy making.

Undernutrition cannot be addressed through one social sector alone, but rather through consolidated efforts at the national level, requiring a comprehensive and coordinated multi-sectoral approach. The analysis of the social and economic consequences of child undernutrition revealed a connection between this and increased health care costs due to illness, as well as an increased educational burden due to higher repetition and early drop-out rates which in turn contribute to reduced labour productivity. The study highlights that long-term sustainable development and achieving SDGs (Sustainable Development Goals) cannot be achieved without effectively combatting undernutrition and the elimination of childhood stunting, as key -component of the social development agenda.

A reduction in the number of stunted children in Sudan will be an indicator to measure the effectiveness of social protection policies and interventions which would contribute to improved living conditions as well as reduce potential cognitive, mental and psychomotor impairment. By removing barriers caused by undernutrition, these children will have the same opportunities for success as their counterparts, who have enjoyed healthy childhoods. Achieving this will serve as an important element for increasing inclusive growth in the country.

This report on The Economic and Social Impacts of Child Undernutrition in Sudan is part of a wider regional study on The Cost of Hunger in Africa (COHA). We acknowledge its production under the national leadership of the National Council of Child Welfare (NCCW). In the development of this study we would like to thank the African Union Commission, the New Partnership for Africa's Development, the UN Economic Commission for Africa and the World Food Programme for bringing this issue to the centre of the development agenda. Lastly but not the least, this report could not have been prepared without the real engagement and support of multiple national Ministries and Agencies.

Name

Acknowledgements

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The initiation and implementation of the study was under the direct supervision of extensive team from the NCCW led by Ms Swad Abdellah Eltahir, the former Secretary General, and Mr Osman Abu-Fatima, Secretary General of the NCCW. The team was composed of Dr. Ghada Elhadari as technical coordinator, Mr Mohammed Issa and Ms Kamelia Omer as administrative coordinators, Ms Rasha Abd Elhafiz (Research Department), Mr Mohamed Alhadi (IT Section), Ms Shahinaz Mostafa, Mr Omar, Mr Zaher, Mr Abdullah and Ms Noon. Finally, the NCCW team was actively supported by Ms. Amal, Ms. Lopna, Ms Mona, Mr Hamed and MS kawthar from finance department.

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Finally, special thanks to Dr. Mohammed Mustafa, the National Consultant of the study for his overall technical support, his guidance on primary and secondary data collection and drafting the final study report.

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Acronyms

ACGSD	African Centre for Gender and Social Development
ACS	African Centre for Statistics
ADFNS	Africa Day for Food and Nutrition
ADS	Acute Diarrheal Syndrome
AfDB	African Development Bank
ARI	Acute Respiratory Infection
ARNS	Africa Regional Nutrition Strategy
ATYS-VMD	Africa Ten Year Strategy for the Reduction of Vitamin and Mineral Deficiencies
AU	African Union
AUC	African Union Commission
CAADP	The Comprehensive Africa Agriculture Development Programme
CAMPAS	Central Agency for Public Mobilization and Statistics
CBS	Central Bureau of Statistics
CEN-SAD	Community of Sahel-Saharan States
COHA	Cost of Hunger in Africa
COMESA	Common Market for Eastern and Southern Africa
CNCD	Communicables and Non-Communicable Diseases
DHS	Demographic and Health Survey
ECA	Economic Commission for Africa
ECCAS	Economic Community of Central African States
ECLAC	Economic Commission for Latin America and the Caribbean
EDND	Economic Development and NEPAD Division/ UNECA
FAFS	Framework for African Food Security
FAO	Food and Agriculture Organization
FMOH	Federal Ministry of Health
FTF	Feed the Future
GDP	Gross Domestic Product
GNI	Gross National Income
HBS	Household Budget Survey
HHUES	Household Health Utilization and Expenditure Survey
ICU	Intensive Care unit
IDSC	Information and Decision Support Centre
IFAD	International Fund for Agricultural Development
IGAD	Intergovernmental Authority for Development
ILO	International Labour Organization
IUGR	Intra Uterine Growth Retardation
LBW	Low Birth Weight
MDGs	Millennium Development Goals
MOFEP	Ministry of Finance and Economic Planning
MENA	Middle East and North Africa
MOE	Ministry of Education
MOL	Ministry of Labour

MOSSD	Ministry of Social Security and Development
MUAC	Mid-Upper Arm Circumference
NCCW	National Council of Child Welfare
NCDS	National Centre for Decision Support
NEPAD	The New Partnership for Africa's Development
NGO	Non-Governmental Organization
NIT	National Implementation Team
NPCA	NEPAD Planning and Coordinating Agency
OECD	Organization for Economic Cooperation and Development
PANI	Pan- African Nutrition Initiative
PSS	Public Social Spending
REACH	Renewed Efforts Against Child Hunger
SADC	Southern African Development Community
SHHS	Sudan Household Health Survey
SDG	Sudanese Pound
SDGs	Sustainable Development Goals
SG	Secretary General
SUN	Scaling Up Nutrition
UMA	Union du Maghreb Arabe
UNECA	United Nations Economic Commission for Africa
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations International Children's Emergency Fund
USD	United State Dollar
WAP	Working Age Population
WFP	World Food Programme
WHO	World Health Organization

Executive Summary

The Cost of Hunger in Africa (COHA) is an African Union Commission (AUC) led initiative through which countries are able to estimate the social and economic impact of child undernutrition in a given year. About 16 countries are initially participating in the study. Sudan is part of the phase VI countries.

The COHA study shows that undernutrition among children is a social issue that affects the whole economy, because countries are losing significant sums of money as a result of current and past cases of child undernutrition. It is with this background that in March 2012, a regional COHA study was presented to African Ministers of Finance, Planning and Economic Development, in Addis Ababa, Ethiopia. From this meeting the Ministers issued a resolution confirming the importance of the study and recommending that the COHA study be replicated across African countries.

The COHA study in Sudan is led by the National Council of Child Welfare , with support from the Central Bureau of Statistics (CBS); Federal Ministry of Health (FMOH); Ministry of Education; Ministry of Labour; Ministry of Agriculture; Ministry of Finance and Economic Planning; Ministry of Industry; Central Bank of Sudan; Development partners namely World Food Programme-Sudan. At regional level, the COHA project is led by the African Union Commission (AUC) with technical leadership from World Food Program- Africa Office (WFP).

During the process, all data for the study were collected from national data sources including Multiple Indicators Cluster Survey (MICS) 2014; the Sudan Household survey 2014; Sudan National Bureau of Statistics - Economic Survey and Statistical Abstracts various years, Sudan Labour Force Survey; Central Bank of Sudan 2014; and primary data collected from selected public hospitals, and relevant data from international sources, such World Health Organization, United Nation International Children Emergency Fund and World Bank Data bases.

Methodology

The study is concerned with the construction and estimation of composite indicators that reflect the cost of malnutrition on the populace and the economy. The process delineates the measurable indicators of malnutrition, and then measures the performance of child development through adulthood prospectively and retrospectively taking into consideration the performance in the key domains of livelihood, i.e., education, health, economy and the environment. The methodology uses these key domains as reference domains for data collection. The philosophy underlying the methodology is to measure how malnutrition is triggered by the performance failure in each and every domain of these key domains, and how all that impacts the national economy. The ultimate cost of malnutrition as measured by the failure in the performance in the key domains, is termed 'Cost of Hunger'; and the cost is generalized for the whole economy.

The COHA model estimates the additional cases of morbidity, mortality, school repetitions, school dropouts and reduced physical capacity that can be directly associated with undernutrition in children under the age of five. In order to estimate these social impacts for a single year, the model focuses on the current[1] population, identifies the percentage of that population who were undernourished before the age of five, and then estimates the associated negative impacts experienced by the population in the study year. Using this information and economic data provided by the National Implementation Team (NIT), the model then estimates the associated economic losses incurred by the economy in health, education, and in potential productivity in a single year.

Social and economic impacts of undernutrition

The current levels of child undernutrition illustrate the continuing challenges for reduction of child hunger. It is estimated that 1.8 million of the 7.1 million children under the age of five in Sudan were affected by stunting in 2014 and 767,927 children were underweight. This situation is especially critical for children between 12 and 23 months, where 26 percent of children are affected by stunting.

Sudan has made progress in reducing stunting in children; nevertheless, stunting rates remain high. It is estimated that 7.9 million population, in the working-age population suffered from growth retardation before reaching five years. In 2014, this

1 The model set 2014 as the base year, given the availability of data for that year and in order to ensure the continuity of the study. As it is the most recent possible study year, it is referred to as "current" in this report.

represented 25.2 percent of the population aged 15-64 who were in a disadvantaged position as compared to those who were not undernourished as children. Undernutrition can also be associated with low progression in education system with only 3 out of every 10 learners enrolled in grade 1 progressing (pass level) to form four. This can be attributed to low cognitive skills.

In the last 5 years alone, it is estimated that 172,866 child deaths in Sudan were directly associated with undernutrition. These deaths represent 37.7 percent of all child mortalities for this period. Thus, it is evident that undernutrition significantly exacerbates the rates of death among children and limits the country's capacity to achieve the SDGs, especially goal 3 which is good health and wellbeing to reduce child mortality.

These historical mortality rates will also have an impact on national productivity. The model estimates that an equivalent of 5.2 percent of the current workforce has been lost due to the impact of undernutrition in increasing child mortality rates. This represents 1,077,671 people who would have between 15-64 years old, and part of the working age population of the country. It is estimated that 3,244,243 clinical episodes in Sudan in 2014, were associated with the higher risk present in underweight children. These episodes generated an estimated cost of SDG 4,616 Million.

Based on official information provided by the Ministry of Education, 218,533 children repeated grades in 2014. Using data on increased risk of repetition among stunted students, the model estimated that the repetition rate for stunted children was 5.4 percent, while the repetition rate for non-stunted children was 2.2 percent. Thus, given the proportion of stunted students, the model estimates that 63,215 students, or 28.9 percent of all repetitions in 2014 were associated with stunting.

The costs associated with school dropouts are reflected in the productivity losses experienced by individuals searching for opportunities in the labour market. As such, the impact is not reflected in the school age population, but in the working-age population. Hence, in order to assess the social and economic costs in 2014, the analysis focuses on the differential in schooling levels achieved by the population who suffered from stunting as children and the schooling levels of the population who was never stunted.

In 2014, the 63,215 students who repeated grades (and whose repetitions are considered to be associated with undernutrition) incurred a cost of SDG 140.2 million. The largest proportion of repetitions occurred during primary school, where the cost burden falls mostly on the public education system. The following chart summarizes the public and private education costs associated with stunting.

As in the case of health, the social cost of undernutrition in education is shared between the public sector and the families. Of the overall costs, a total of SDG 92.7 million (66.1 percent) are being covered by the care takers, while SDG 47.5 million (33.9 percent) is borne by the public education system. Nevertheless, the distribution of this cost varies depending on whether the child repeated grades in primary or secondary education. In primary education, the families cover 68.4 percent of the associated costs of repeating a year, where as in secondary the burden on the families is reduced to 51.6 percent. In both cases, the government covers a larger proportion of the burden.

The cost estimates in labour productivity were estimated by identifying differential income associated with lower schooling in non-manual activities, as well as the lower productivity associated with stunted people in manual work, such as agriculture. The opportunity cost of productivity due to mortality is based on the expected income that a healthy person would have been earning, had he or she been part of the workforce in 2014.

Based on information from the Sudan Labour force survey 2011,1it is estimated that the educational gap between the stunted and non-stunted population is 1.6 years. It is important to note that over time there has been an improvement in the average years of schooling among the working population. Whereas, the cohort from 60-64 years shows an average level of school education of 1.8 years, the cohort aged 20-24 shows an average of 7.2 years of education.

The lower educational achievement of the stunted population has an impact on the expected level of income a person would earn as an adult. The model estimates that 6,055,543 people engaged in non-manual activities suffered from childhood stunting. This represents 29.5 percent of the country's labour force that is currently less productive due to lower schooling levels associated to stunting. The estimated annual losses in productivity for this group are SDG 1.018 billion (USD 176.5 million) equivalent to 0.23 percent of the GDP in 2014.

The model estimated that 7.3 million people in Sudan are engaged in manual activities, of which 3.2 million were stunted as children. This represented an annual loss in potential income that surpasses SDG 655.9 million (USD 113.7 million), equivalent to 0.15 percent of the GDP in potential income lost due to lower productivity.

The total losses in productivity for 2014 are estimated at approximately SDG 6.9 billion (USD 1.2 billion), which is equivalent to 1.5 percent of Sudan's GDP. As presented in Figure 4.12, the largest share of productivity loss is due to reduced productivity due to undernutrition-related mortality which represents 75.6 percent of the total cost. The lost productivity in non-manual activities represents 14.8 percent of the costs. The income differential in manual labour, due to the lower physical and cognitive capacity of people who suffered from growth retardation as children represents 9.5 percent of the total costs.

For Sudan, the total losses associated with undernutrition are estimated at SDG 11.6 billion, or USD 2 billion for the year 2014. These losses are equivalent to 2.6 percent of Sudan 2014 GDP. The highest element in this cost is the loss in potential productivity as a result of undernutrition-related mortalities

Future scenarios

The model generates a baseline that allows development of various scenarios based on nutritional goals established in each country using the prospective dimension. These scenarios are constructed based on the estimated net present value of the costs of children born in each year between 2014 – 2025 and 2014 – 2030.

The scenarios developed for this report are as follows:

1. Scenario #1: Cutting by half the prevalence of child undernutrition by 2025. In this scenario, the prevalence of underweight and stunted children would be reduced to half of the 2014 values corresponding to the reference year. In the case of Sudan this would mean a constant reduction of 1.2 percent points annually in the stunting rate from 38.2percent (estimate for 2014) to 19.1percent in 2025. A strong effort has to be carried-out to complete this scenario that would require a revision of the effectiveness of on-going interventions for the reduction of stunting as the average rate of reduction for stunting between 2005 and 2010 was estimated at 4.7 percent.

2. Scenario #2: The 'Goal' Scenario. Reduce stunting to 10 percent and underweight children to 5 percent by 2025. In this scenario, the prevalence of stunted children would be reduced to 10 percent and the prevalence of underweight children under the age of five, to 5 percent. Currently, the global stunting rate is estimated at 26 percent, with Africa having the highest prevalence at 36 percent. This Goal Scenario would require a true call for action and would represent an important regional challenge, in which countries of the region could collaborate jointly in its achievement. The progress rate required to achieve this scenario would be 4.7 percent annual reduction for a period of 12 years, from 2014 to 2025.

cutting undernutrition by half by 2025 would represent a reduction in costs of over 30.31 billion SDG, equivalent to $US2.5 billion for the period of 11 years, from 2014 to 2025. Although the tendency of savings would not be linear, as they would increase over time with the achieved progress, a simple average of the annual savings would represent $US 344.79 million per year. In the case of the Goal Scenario, the savings would increase to 62.7 billion SDG, or $USD 713.34 million, which represent a simple average of $US 59.44 million per year.

Recommendations

- Sudan must review its national development frameworks to ensure that the reduction of the stunting prevalence is an outcome indicator of the its social and economic development policies.
- Ambitious targets should be set in Sudan for the reduction of stunting that go beyond proportional reduction, and to establish an absolute value as the goal at 10 percent. More specifically, investment should be increased in combating undernutrition during the first 1000 days of a child's life.
- Sudan should put in place a comprehensive multisectoral nutrition policy, strategy and plan of action, with strong political commitment and allocation of adequate resources for its implementation across all line ministries.
- Promote the delivery of nutrition services integrated with other essential services and utilization of essential health services should be increased and nutrition services should be delivered at all contact points

- Promote optimal complementary feeding practices: Best practices should be observed in some area regarding improving the complementary feeding practice, through improved local food processing should be scaled up and interventions should be employed to enrich food with micronutrients.
- Mandatory fortification of staple foods (flour, oil, salt) with multiple micronutrients should be initiated and scaled up.
- Improve monitoring and evaluation systems and clearly link these to prevention interventions.
- Schools can serve as good platform for behaviour change communication for future generations through nutrition and health education, as well as for health check-ups and screening.
- Increase awareness and advocacy of key stakeholders at all levels on the social and economic impacts of child under nutrition to ensure that nutrition, with a focus on addressing stunting, receives the highest possible level of commitments.


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Section I

The Cost of Hunger in Africa

Section I: The Cost of Hunger in Africa:

1.1 Towards the Elimination of Child Undernutrition in Africa

1.1.1 Introduction: Why is it important?

Over the past decade, Africa has experienced a remarkable economic performance that has made the continent increasingly attractive for global investment and trade. The pace of real GDP growth on the continent has doubled in the last decade, and six of the world's fastest growing economies are in Africa[2]. Yet, the continent still displays some of the highest rates of child undernutrition in the world.

Human capital is the foundation of social and economic development, as articulated in the African Agenda 2063 and the Sustainable Development Goals (SDGs), Agenda 2030. Improved nutritional status of people has a direct impact on economic performance through increased productivity and enhanced national comparative advantage. In order for Africa to maximize its present and future economic prospects, there is an urgent need for sustainable, cost-effective interventions that address the nutritional situation of the most vulnerable members of its society.

The 2030 Agenda for Sustainable Development places a high premium on promoting good nutritional status for realizing inclusive development. More specifically, the Sustainable Development Goal (SDG 2) which aims at "ending hunger, achieving food security and improved nutrition and promoting sustainable agriculture" will contribute to the attainment of the other interrelated goals. Thus, Goal 2 should not be seen in isolation from Goals 1 (end hunger), 3 (ensure healthy lives), 4 (ensure inclusive and equitable quality education), 5 (achieve gender equality), 8 (promote sustained, inclusive and sustainable economic growth) and 10 (reduce inequality). Coherent regional and national strategies and well-coordinated programmatic interventions are urgently required to achieve the SDG on nutrition and ensure that small gains are not reversed.

As noted by the African Heads of State and Government in 2014, food security without improved nutrition will not deliver the desired socio-economic outcomes, as the number of those affected by hunger and malnutrition has continued to increase over the past few years. Therefore, if child undernutrition were reduced, there would be a direct improvement in child mortality rates, as undernutrition is the single most important contributor to child mortality.[3] If women were not undernourished as children, they would be less likely to bear underweight children. Further, healthy children would achieve better education, be more productive as adults and have higher chances of breaking the cycle of poverty.

Undernutrition leads to a significant loss in human and economic potential. The World Bank estimates that undernourished children are at risk of losing about 10 percent of their lifetime earning potential, thus affecting national productivity. Recently, a panel of expert economists at the Copenhagen Consensus Conference concluded that fighting malnourishment should be the top priority for policymakers and philanthropists.[4] At that conference, Nobel laureate economist Vernon Smith stated that: "One of the most compelling investments is to get nutrients to the world's undernourished. The benefits from doing so – in terms of increased health, schooling, and productivity – are tremendous."[5] Improving the nutritional status of children is therefore a priority that needs urgent policy attention to accelerate socio-economic progress and development in Africa. However, in spite of the compelling economic value of nutrition interventions, investments with apparent shorter-term returns are prioritized in social budgets. Hence, efforts need to be scaled up to sensitize the general population, policymakers and development partners on the high costs of undernutrition in order to strengthen national and international commitments and ensure that young children in Africa grow healthy and properly nourished.

2 "World Economic Outlook Database October 2012. www.imf.org/external/pubs/ft/weo/2012/02/weodata/index.aspx.

3 Robert E. Black et al. Maternal and Child Undernutrition: Global and Regional Exposures and Health Consequences. The Lancet, 371, No. 9608, 2008. doi: 10.1016/S0140- 6736(07)61690-0.

4 Copenhagen Consensus 2012. Top Economists Identify the Smartest Investments for Policy-Makers and Philanthropists. 14 May 2012. www.copenhagenconsensus.com/Default.aspx?ID=1637.

5 Idem.

Positioning nutrition interventions as a top priority for development and poverty reduction is often difficult, partly due to the lack of credible data on both short- and long-term returns. Indeed, there is not enough country-specific evidence to demonstrate how improved nutrition can have a direct impact on school performance, and thereby improving opportunities in the labour market and physical work. Additionally, nutrition is too often regarded as a health issue, disregarding the rippling social and economic implications it has on other areas of development.

Despite the aforementioned challenges, efforts continue, both at the regional and global levels, to address the issues of undernutrition and hunger. At the regional level, these efforts include initiatives, such as the African Regional Nutrition Strategy (ARNS), the Comprehensive Africa Agriculture Development Programme (CAADP), especially CAADP Pillar III that focuses on reducing hunger and improving food and nutrition security, the Pan-African Nutrition Initiative (PANI), the Framework for African Food Security, the Africa Ten-Year Strategy for the Reduction of Vitamin and Mineral Deficiencies (ATYS-VMD),

Africa Day for Food and Nutrition Security (ADFNS), and the recently launched Africa Day for School Feeding. At the global level, initiatives include Renewed Efforts Against Child Hunger (REACH), Purchase for Progress (P4P), Scaling Up Nutrition (SUN), Feed the Future, the "1,000 Days" partnership, as well as the Abuja Food Security Summit of 2006. All these efforts are designed to reduce hunger, malnutrition and vulnerability in a bid to also achieve the Sustainable Development Goals as well as the Africa Agenda 2063.

Within the framework of the African Regional Nutrition Strategy (2015–2025),[6] the objectives of the African Task Force on Food and Nutrition Development[7] and CAADP, the African Union, and the New Partnership for Africa's Development (NEPAD) Planning and Coordinating Agency (NPCA), the United Nations Economic Commission for Africa (UNECA), and the World Food Programme (WFP) combined their efforts to conduct the Cost of Hunger Study on the Social and Economic Impact of Child Undernutrition in Africa. This study is built on a model developed by the United Nations Economic Commission for Latin America and the Caribbean (ECLAC). Through a South-South cooperation agreement, ECLAC has supported the adaptation of the model to the African context and continues to support the implementation of the study in the ongoing countries.

This study aims at generating evidence to inform key decision-makers and the general public about the cost African societies are already paying for not addressing the problem of child undernutrition. The results provide compelling evidence to guide policy dialogue and increase advocacy around the importance of preventing child undernutrition. Ultimately, it is expected that the study will encourage revision of current budgetary allocation practices in each participating country to ensure provision of the human and financial resources needed to effectively combat child undernutrition, specifically during the first 1,000 days of life when most of the damage occurs.

1.1.2 Current Food and Nutrition Situation in Africa

Globally, there has been tremendous progress in reducing both the rate of stunting (low height for age) and the number of stunted children over the past 28 years, 1990 to 2018. In Africa, the reported rate of stunted children has decreased from 42.1 percent in 1990 to 30 percent in 2018 (see Table 1.1). Nevertheless, over the same period, the absolute number of stunted children has increased from 46.4 million to 58.8[8] aftermillion. Southern Africa has the least proportion of these children, 1.9 million, representing 28.7 percent while the largest proportion of these children, 24 million, is located in East Africa, representing more than 40.7 percent of all stunted children on the continent.

6 African Regional Nutrition Strategy (2005-2015). Objectives I-III: I. To increase awareness among governments of the region, regional and international development partners and the [international] community on the nature and magnitude of nutrition problems in Africa and their implications for the development of the continent and advocate for additional resources for nutrition. II. To advocate for renewed focus, attention, commitment and a redoubling of efforts by member states, in the wake of the worsening nutrition status of vulnerable groups. III. To stimulate action at the national and regional level that lead to improved nutrition outcomes, by providing guidance on strategic areas of focus.

7 African Union, "CAHM5 moves into gear with meeting on food and nutrition development", 14 April 2011, http://www.au.int/en/sites/default/files/task%20force%20on%20food%20and%20nutrition%20development.pdf.

8 United Nations Children's Fund, World Health Organization, World Bank. UNICEF-WHO-World Bank Joint Child Malnutrition Estimates. UNICEF, New York; WHO, Geneva; World Bank: Washington, DC

Table 1: ESTIMATED PREVALENCE AND NUMBER OF STUNTED CHILDREN UNDER FIVE YEARS OF AGE (MODERATE OR SEVERE), BY UNITED NATIONS REGION, 1990, 2010 and 2018

	Prevalence estimate (%)			Number (millions)		
Region	**1990**	**2010**	**2018**	**1990**	**2010**	**2018**
Africa	**42.1**	**33.6**	**30.0**	**46.4**	**56.0**	**58.8**
Eastern	51.9	39.8	35.2	19.2	23.5	24.0
Middle	44.3	35.4	32.1	5.9	8.6	9.4
Northern	28.0	19.9	18.3	6.1	4.8	5.0
Southern	35.0	30.9	29.3	2.1	2.0	2.0
Western	40.7	32.3	29.2	13.2	17.2	18.2

Source: UNICEF-WHO-World Bank joint child malnutrition estimates.

The rising number of food insecure and undernourished people continues to pose serious challenges in Africa. Over the past few years, the increase in global food prices, followed by the economic and financial crisis, have pushed more people into poverty, vulnerability and hunger. Even though the number of undernourished people has fallen globally by 13.2 percent from 1 billion to 868 million in the last 20 years, Africa has fallen back, reporting an increase in the absolute number of underweight children from 32.4 million to 36.9 million (see Table 2)[9]. Africa's share in the world's undernourished population has decreased from 35.5 percent in 1990 to 20.5 percent in 2017. However, this alarming rate still calls for stronger efforts to improve food security and nutrition in the continent.

Table 2: NUMBER OF UNDERWEIGHT PEOPLE, BY REGION, 1990 TO 2017 (In millions)

Region	Prevalence in % 1990	Number in million	Prevalence in % 2017	Number in million
Africa	28.2	25.6	17.1	29.0
Asia	32.1	128.0	11.4	59.0
Latin America & Caribbean	7.6	4.3	6.1	1.4
Oceania	17.9	0.2	7.5	0.3

Source: United Nations Children's Fund, World Health Organization, The World Bank. UNICEF-WHO-World Bank Joint Child Malnutrition Estimate.

1.1.3 Mandate to Advocate for Nutrition in Africa

At the 4th Joint Meeting of the AU Conference of Ministers of Economy and Finance and the ECA Conference of African Ministers of Finance, Planning and Economic Development held in 2012, the African Union (AU) recognized the compelling evidence that vibrant economic growth in Africa has not translated into equitable social progress, particularly with regards to poverty reduction and job creation.

Experience from other regions of the world – most notably Latin America and Asia – confirms that cutting hunger and thereby achieving food and nutrition security in Africa is not only one of the most urgent needs for reducing vulnerability and enhancing resilience, but also offers one of the highest return outcomes for broader social and economic development. This suggests that, had more progress been made against hunger in Africa, the continent's recent growth performance would have been even more impressive with potentially stronger impacts on poverty reduction.

Nevertheless, advocating for nutrition investments has been a challenge for development stakeholders. Often, child nutrition is perceived as a long-term investment, which will take several years to generate social returns, thus leading to the prioritization of short-term investments in budget allocations. Furthermore, food security and response to emergency hunger situations often retain most of the attention associated to nutrition investments.

9 FAO, WFP and IFAD. 2018. The State of Food Insecurity in the World 2018. Economic growth is necessary but not sufficient to accelerate reduction of hunger and malnutrition. Rome: FAO

"The Conference of Ministers…

Welcomes the multi-country study on the Cost of Hunger in Africa being led by the African Union Commission and the Economic Commission for Africa, in collaboration with the World Food Programme, to quantify the aggregate social and economic impacts of chronic hunger in Africa;

Anticipates that the study will lead to increased understanding among key national and regional policymakers of the depth and breadth of child undernutrition on the continent, and its aggregate social and economic consequences, and thereby, establish a firmer foundation for policies and investments to cut hunger in Africa; and

[Requests partners] to expedite the successful completion of the study, including wide dissemination of the results at country and regional levels."

Extract from Resolution 898 (XLV) the Cost of Hunger in Africa: Social and Economic Impacts of Child Undernutrition

Recognizing these challenges, the African Union Commission (AUC), strongly supported by WFP, NEPAD and other partners, proposed the development of the COHA study at the 5th Joint Meeting of the AU Conference of Ministers of Economy and Finance and the ECA Conference of African Ministers of Finance, Planning and Economic Development in March 2012. The purpose of this multi-country study was to provide strong evidence on the social and economic consequences of child undernutrition, in order to inform, raise awareness, build consensus and catalyse action towards undernutrition in Africa. As a result, Resolution 898 (XLV)[10] the Cost of Hunger in Africa: Social and Economic Impacts of Child Undernutrition was adopted, acknowledging the importance of the study and recommending it to continue beyond the initial stage.

This mandate was a clear guideline for the AUC to integrate the COHA study into the advocacy efforts of the ARNS (2005-2015)[11] which has now been revised to 2025, and use the results of the study as a tool to mainstream nutrition in the development process. The resolution also promoted a dialogue with political actors at the country level, motivated consideration of nutrition issues within the economic and planning sectors, and repositioned child nutrition in the context of economic development. This report is the result of the commitment by the AUC, NEPAD, WFP and other partners to highlight the tangible consequences of child undernutrition in Africa.

Most recently, the Heads of State and Government of the African Union, having met at their Twenty third Ordinary Session of the AU Assembly in Malabo, Equatorial Guinea, from 26 to 27 June 2014, on the theme of the African Year of Agriculture and Food Security: "Transforming Africa's Agriculture for Shared Prosperity and Improved Livelihoods through Harnessing Opportunities for Inclusive Growth and Sustainable Development", further reiterated the importance of COHA. In Declaration 4 of the Assembly, titled "Declaration on Nutrition Security for Inclusive Economic Growth and Sustainable Development in Africa" the Heads of State noted with concern that the results of the study on the Cost of Hunger in Africa (COHA) revealed the degree to which child under-nutrition influences health and educational outcomes; the additional barrier it has on children's ability to achieve their full potential; and the impact it has on national productivity; and called upon Member.

1.1.4 Adapting a Methodology for Africa: A Consultative Process

The model for the COHA study represents a step forward in estimating the social and economic consequences of child undernutrition in Africa. Several national and regional efforts have been implemented to assess the costs of undernutrition globally and in the region. Notable initiatives at the regional level include those led by ECLAC, carried out jointly with WFP in Latin America and the Caribbean (LAC) and the PROFILES initiatives[12] which developed similar country-level estimations in selected countries worldwide. The COHA, however, represents the only effort constructed for the African continent, involving nutrition experts from the continent, who provided recommendations during the adaptation process, with critical support of country teams. The model developed by ECLAC to estimate the social and economic consequences on child undernutrition

10 African Regional Nutrition Strategy: 2005-2015, report (Addis Ababa: African Union), http://www.who.int/nutrition/topics/African_Nutritional_strategy.pdf

11 Ibid

12 13 "FHI 360 Profiles," FHI 360 Profiles, accessed September 27, 2013, http://fhi360profiles.org/.

in LAC[13] presented the most appropriate base to develop a model for Africa. In the development of the model for LAC, the authors focused on the consequences of child undernutrition from a life-cycle approach, avoiding the potential overlaps with other nutritional deficiencies. This approach proved to be an important political instrument to mobilize stakeholders around nutrition in LAC, and was considered by many to be state-of-the-art knowledge in this field.

The development of the COHA model proved to be a good practice of South-South collaboration between two regional UN Economic Commissions. ECLAC, AUC and WFP Africa office worked together in a series of joint technical activities and consultations to transfer knowledge and generate the adjustments for the development of the new model to Africa. An interdivisional working group was created within ECA that included the African Centre for Statistics, the African Centre for Gender and Social Development, the Economic Development and NEPAD Division of the ECA as well as a number of UN partners, namely WFP, UNICEF, the International Labour Organization (ILO) and WHO – to ensure multidisciplinary contributions in the development of the model.

At the regional level, the technical validation of the COHA model was provided by the African Task Force for Food and Nutrition Development (ATFFND). The Task Force, which brings together regional nutrition experts and practitioners, was the ideal body to provide guidance in the development of the model. In consecutive meetings, the ATFFND provided key recommendations, thus laying out a roadmap for the adaptation process, and finally expressed its satisfaction with the proposed COHA model.

To facilitate the implementation of the project, leadership roles were identified: the AUC Department of Social Affairs and the NEPAD Planning and Coordinating Agency led the initiative; ECA/ECLAC coordinated its implementation, while WFP and other partners supported the capacity building process, both at regional and country levels. Further, the following governing structures were established:

1. The Steering Committee/ATFFND: The high-level Steering Committee is chaired by the AUC. The Steering Committee is charged with convening partner organizations, approving the study design and action plan and overseeing the implementation of the study and dissemination of results. The Steering Committee also provides political support to the initiative.

2. The Regional Secretariat: The Regional Secretariat, based at WFP Africa office, worked through a small technical team, drawn from NEPAD, AUC, WFP, ECLAC and other relevant organizations, to support the preparation, implementation and dissemination of the study, as well as to facilitate smooth and quality work of the national implementation teams and expert committees. The Secretariat reported to the Steering Committee and executed the study budget.

3. The National Implementation Team (NIT): The core implementation of the study was carried out by a national team in each participating country, drawn from relevant governmental institutions, such as the Federal Ministry of Health (FMOH), Ministry of Education (MOE), Ministry of Labour (MOL), Ministry of Social Security and Development (MOSSD), Ministry of Agriculture (MOA), Ministry of Finance and Economic Planning (MOFEP) and the Central Bureau of Statistics (CBS). In certain situations, a broader reference group was also created to include other actors and United Nations agencies, such as WFP and UNICEF. The WFP country offices facilitated the process according to specific country situations and supported coordination of the NIT as required.

1.1.5 Guiding Principles

Throughout the adaptation, implementation and utilization of the COHA model, four guiding principles were developed. With the overall goal of improving the nutritional situation in Africa, these principles allowed the team to approach the study in a holistic manner, considering the necessary steps for its implementation. The four guiding principles are described below:

1.1.5.1 National ownership of the process

One of the guiding principles in the development of the COHA study is to engage national experts and policy makers as the main actors of the process. To this purpose, a national training workshop was carried out in the early stages of the implementing process, bringing together practitioners across various sectors in the country in order to analyse the challenges ahead and

13 a Rodrigo Martínez and Andrés Fernández, Model for Analysing the Social and Economic Impact of Child Undernutrition in Latin America (Santiago de Chile: Naciones Unidas, CEPAL, Social Development Division, 2007).

jointly produce a roadmap. As a result of this workshop, NITs were established, and an initial training on the model and data requirements was carried out.

Following, NITs presented a series of specific recommendations for implementing the COHA model in the country. This feedback allowed the National Consultant and the study Technical Coordinator to prepare a final roadmap for methodological adaptation, adjust the data collection instruments and develop a final proposal for the COHA model in Sudan.

1.1.5.2 Building national capacity to advocate for child nutrition

A second guiding principle for the COHA is to ensure that national capacity is strengthened during the implementation of the study. Similar costing initiatives have had limited impact due, in part, to the lack of national ownership and limited understanding by the stakeholders of the technical aspects of the study. These elements hinder the national stakeholders' capacities to effectively communicate the results, which could limit the policy impact of the study.

The main implementing actors of COHA in Sudan were specialists from the key government institutions, academics and practitioners, led by the National Council of Child Welfare (NCCW). Once a team of twenty-two specialists was established, representing different stakeholders, a training workshop was held to review all technical aspects of the model, and form a task force for data collection and develop an initial communication strategy. In this workshop, a work plan was developed by the NIT that served as a guideline for implementation activities.

The Regional Secretariat supported the capacity building process of the technical leading team and the NITs by holding regular teleconferences with representatives of the team and by providing technical assistance in the analysis of data and initial results. The national ownership of the study was emphasized by creating an NIT-led approach and by relying on nationally-validated information. Once a country report was drafted, a national validation workshop of the results was held by the NIT and specific advocacy documents were prepared for key stakeholders.

One of the advantages of this process was the integration of the COHA by the NITs within country's national nutritional strategies. This was possible as the actors participating in the study were the same professionals shaping national nutritional strategies. This ensured alignment within the processes and maximized the potential contribution and sustainability of the initiative.

1.1.5.3 Engagement of COHA with global nutrition initiatives and movements

The third guiding principle for the COHA is to generate synergies with partners and global initiatives to maximize contributions. To achieve this, strong efforts were made to link the COHA with relevant initiatives that contribute to reducing child undernutrition.

The Scaling-Up Nutrition (SUN) Movement was launched in 2010 and includes selected countries with high burdens of malnutrition. The purpose of the movement is described as follows:

- It unites people - governments, civil society, the United Nations, donors, businesses and scientists – in a collective effort to improve nutrition. The Movement recognizes that good nutrition in the 1,000 days of a mother's pregnancy until her child's second birthday is an essential requirement and right for each world citizen to earn, learn, stay healthy and achieve his or her lifetime potential. The SUN Movement is founded on the compelling evidence that investment in nutrition yields major economic returns
- COHA contributes to the SUN Movement by presenting strong arguments for investing in child nutrition in specific country contexts. By doing so, countries have developed the capacity to generate change in the nutritional situation of their populations.

Another important global actor in the nutrition context is represented by the Renewed Efforts Against Child Hunger (REACH) initiative. This joint initiative proposed by WFP, WHO, UNICEF and FAO provide technical assistance to national governments in developing plans and strategies to scale up nutrition investments. An important part of their advocacy actions

at the country level includes engaging non-traditional actors in discussions on nutrition, in order to mainstream nutrition in their planning and activities. The COHA also represents an opportunity for joint collaboration, as it provides strong evidence on the consequences of stunting in educational performance, the loss of working hours by working age population and the loss in manual and non-manual productivity – thus helping to position nutrition in the wider development agenda. REACH facilitators are also typically members of the NIT in each country where REACH is present.

The African Leaders for Nutrition (ALN) initiative is another platform for high-level political engagement to advance nutrition in Africa. It is led by a group of ALN Champions, comprising current and former heads of state, finance ministers and eminent leaders with the power to catalyse and sustain high-level political leadership and commitment to end malnutrition in Africa. The Assembly of Heads of State and Governments of the African Union (AU) at the 30th Ordinary AU Summit, held in Addis Ababa, Ethiopia, on 31 January 2018, endorsed the ALN initiative.

With a special focus on the first 1,000 days of a child's life and the grey matter infrastructure, the initiative aims to influence and generate innovative investments towards nutrition and food security that will build a foundation for productive human capital in Africa. *

1.1.5.4 Strategic advocacy for change

The fourth guiding principle of the COHA is to ensure that the results reach key stakeholders with the capacity to make a change. The communication strategy of the COHA is a basic component of the project. As a result, strong efforts are carried out by each NIT to reach decision-makers with the appropriate information in order to increase their interest and understand the consequences of child undernutrition. In this regard, a six-step approach has been developed, as follows

- Familiarize the team with the problems contributing to undernutrition and proven nutrition interventions;
- Identify and categorize key actors;
- Develop objectives for each actor;
- Produce information materials and brief stakeholders;
- Adapt results and present them to target decision-makers; and follow up and provide support.
- Each NIT was provided detailed information on the six steps.

Additionally, the NIT held communication and advocacy sessions at each of the technical workshops to discuss the implementation of the six-step approach.


WFP

Section II

Methodology and Data

Section II: Methodology and Data

2.1 Cost of Hunger in Africa; The Methodology

2.1.1. Brief description of the model

2.1.1.1 Conceptual framework

"Hunger" is an overarching term that reflects an individual's food and nutrition insecurity. It is caused and affected by a set of contextual factors. Food and nutrition insecurity occur when part of the population does not have assured physical, social and economic access to safe and nutritional food to satisfy dietary needs.

Box 1: Definition of terms

Chronic hunger: The status of people, whose food intake regularly provides less than their minimum energy requirements leading to undernutrition.[14]

Child undernutrition: The result of prolonged low levels of food intake (hunger) and/or low absorption of food consumed. It is generally applied to energy or protein deficiency, but it may also relate to vitamin and mineral deficiencies. Anthropometric measurements (stunting, underweight and wasting) are the most widely used indicators of undernutrition.[15]

Malnutrition: A broad term for a range of conditions that hinder good health caused by inadequate or unbalanced food intake or from poor absorption of food consumed. It refers to both undernutrition (food deprivation) and over nutrition (excessive food intake in relation to energy requirements.[16]

Food insecurity: Exists when people lack access to sufficient amounts of safe and nutritious food, and therefore are not consuming enough for an active and healthy life. This may be due to the unavailability of food, inadequate purchasing power or inappropriate utilization at household level.[17]

Food vulnerability: Reflects the probability of an acute decline in food access or consumption, often in reference to some critical value that defines minimum levels of human wellbeing.[18]

Nutrition security thus depends on a person's food security, as well as good health, a healthy environment, and good caring practices. Specifically, nutrition security can be described as, "appropriate quantity and combination of food, nutrition, health services and care taker's time needed to ensure adequate nutrition status for an active and healthy life at all times for all people."[19]

A direct and measurable consequence is low birth weight, underweight and/or lower than normal height-for-age. Levels of nutrition security in a country are related to epidemiological and nutritional transitions, which can be evaluated to assess the population's nutritional situation. Further, a person's nutritional situation is part of a process that is expressed differently depending on the stage of the life cycle: intrauterine and neonatal life, infancy and pre-school, school years or adult life. This is because the nutrient requirements and the needs are different for each stage.[20]

Below is the discussion of the central elements, considered in the Cost of Hunger model, to estimate the effects and costs of

14 "Hunger statistics", FAO Hunger Portal, Undernourishment or Chronic Hunger, FAO, accessed March 14, 2013, http://www.fao.org/hunger/ en/.

15 Ibid

16 Ibid

17 Ibid

18 WFP, VAM Standard analytical framework, World Food Programme, 2002.

19 USAID, USAID Commodities reference guide, Annex I: Definitions, January 2006, http://transition.usaid.gov/our_work/humanitarian_assistance/ffp/crg/annex-I.htm.

20 Rodrigo Martínez and Andrés Fernández, Model for analysing the social and economic impact of child undernutrition in Latin America, Naciones Unidas, CEPAL, Social Development Division, Santiago de

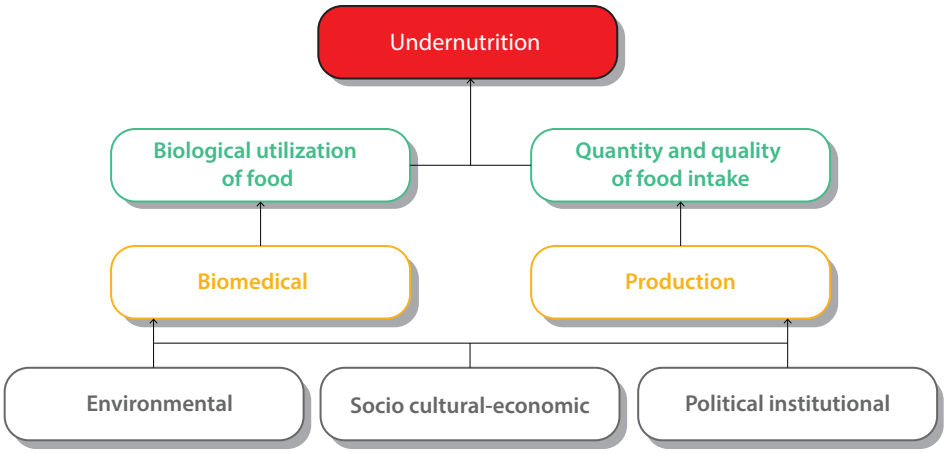
child undernutrition based on the concepts mentioned above, along with a brief description of the causes and consequences of undernutrition. The discussion also describes the dimension of analysis and the principal methodological aspects used to interpret the results.[21]

2.1.2 Causes of undernutrition

The main factors associated with undernutrition, as a public health problem, can be grouped into the following: environmental (natural or entropic causes), sociocultural-economic (linked to poverty and inequality) and political-institutional. Together, these factors increase or decrease biomedical and productivity vulnerabilities, through which they determine the quantity and quality of dietary intake and the absorption capacity, which constitute the elements of undernutrition. [22]

Each of these factors helps increase or decrease the likelihood of a person to suffer from undernutrition. Further, the importance of each of these factors depends on the level of the country's demographic and epidemiological transition as well as on the person's current stage in the life cycle. Together these factors determine the intensity of the resulting vulnerability to undernutrition.

FIGURE 1: CAUSES OF UNDERNUTRITION



Source: Rodrigo Martinez and Andrés Fernández, Model for analysing the social and economic impact of child undernutrition in Latin America (see footnote) based on consultations carried out by authors.[23]

Environmental factors define the surroundings in which the subject and his or her family live, including the risks stemming from the natural environment itself and its cycles (from floods, droughts, frosts, earthquakes, and other phenomena), and those produced by humans themselves (such as the contamination of water, air, and food, the expansion of agriculture into new territories, etc.). The sociocultural-economic determinants include elements associated with poverty and inequality, education and cultural norms, employment and wages, access to social security and coverage of aid programmes. The political-institutional factors encompass government policies and programmes aimed specifically at solving the population's food and nutritional problems.

Production factors include those directly associated with the production and access to food by the population at risk. The availability and autonomy of each country's dietary energy supply depend directly on the characteristics of production processes, the degree to which they utilize natural resources and the extent to which these processes mitigate or aggravate environmental risks.

21 A summarized version of the theoretical background and the basic characteristics considered in the model of analysis are presented here. For a more detailed discussion of the model, see Rodrigo Martínez and Andrés Fernández, Model for analysing the social and economic impact of child undernutrition in Latin America, Naciones Unidas, CEPAL, Social Development Division, Santiago De Chile, 2007.

22 Rodrigo Martínez and Andrés Fernández, Model for analysing the social and economic impact of child undernutrition in Latin America, Naciones Unidas, CEPAL, Social Development Division, Santiago de Chile, 2007.

23 Rodrigo Martínez and Andrés Fernández, Model for Analysing the Social and Economic Impact of Child Undernutrition in Latin America (Santiago de Chile: Naciones Unidas, CEPAL, Social Development Division, 2007).

Finally, biomedical factors take into account the individual's susceptibility to undernutrition, insofar as deficiencies in certain elements limit the capacity to make biological use of the food consumed (regardless of quantity and quality).

2.1.3 Consequences of undernutrition

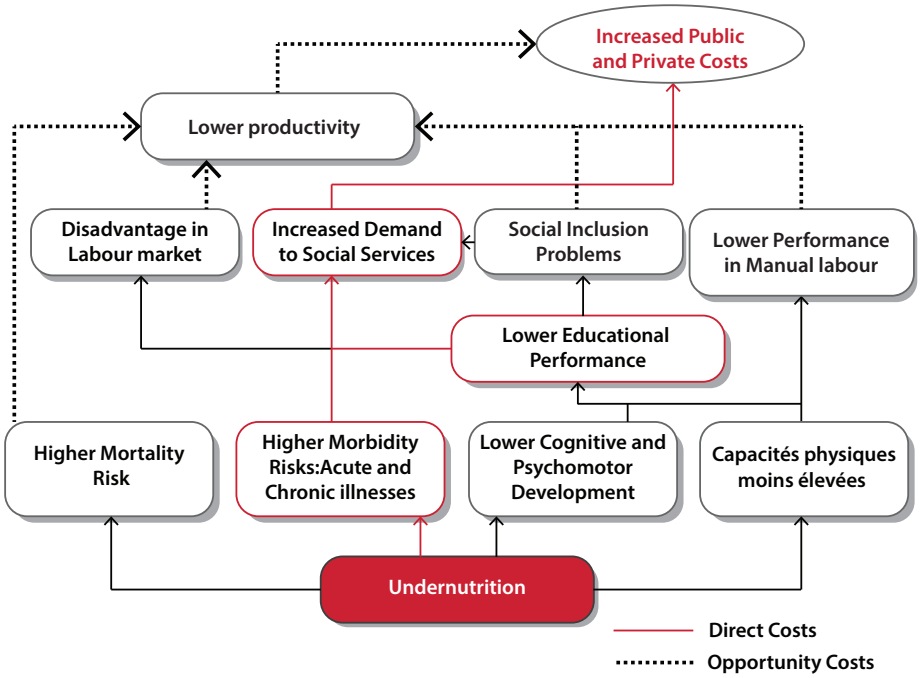
Child undernutrition has long-term negative effects on a person's life[24], most notably in the aspects of health, education, and productivity, quantifiable in costs and expenditures to the public and private sectors. Consequently, these effects exacerbate problems in social integration and increase or intensify poverty.A vicious cycle is perpetuated as vulnerability to undernutrition grows.

Undernutrition may have immediate or evolving impacts throughout a person's lifetime, although individuals who suffered from undernutrition during early years of their life cycle (including intrauterine) are more likely to be undernourished later in life. Health studies have shown that undernutrition leads to increased appearance or intensified severity of specific pathologies, and increases the chance of death during specific stages of the life cycle.[25] The nature and intensity of the impact of undernutrition on pathologies depends on the epidemiological profile of a given country.

In education, undernutrition affects student performance through disease-related weaknesses and results in limited learning capacity associated with deficient cognitive development.[26] This translates into a greater probability of starting school at a later age, repeating grades, dropping out of school and ultimately obtaining a lower level of education.

Later in life, individuals may experience lower physical capacity in manual labour as a result of stunting.[27] Stunting, which is caused by food deprivation and nutrient deficiencies, is established by low height-for-age measurements during childhood. In adulthood, it leads to an overall reduced body mass when compared to the full adult potential.

Figure 2: Consequences of undernutrition



Source: Modified from Rodrigo Martínez and Andrés Fernández, Model for analysing the social and economic impact of child

24 Alderman H., et al., "Long-term consequences of early childhood malnutrition", FCND Discussion Paper No. 168, IFPRI, 2003

25 Amy L. Rice et al., "Malnutrition as an underlying cause of childhood deaths associated with infectious diseases in developing countries," Bulletin of the World Health Organization 78, No. 2000,

26 Melissa C. Daniels and Linda S. Adair, "Growth in young Filipino children predicts schooling trajectories through high school," The Journal of Nutrition, March 22, 2004, Jn.nutrition.org.

27 Lawrence J. Haddad and Howarth E. Bouis, "The impact of nutritional status on agricultural productivity: wage evidence from the Philippines," Oxford Bulletin of Economics and Statistics 53, No. 1, February 1991, doi:10.1111/j.1468-0084. 1991.mp53001004. x.

undernutrition in Latin America (see footnote) based on consultations carried out by authors. [28]

Undernutrition and its effects on health and education also translate into heavy economic costs for society at large. Each of the negative impacts in health, education, and productivity, described above, leads to a social, as well as an economic, loss to the individual or the society.

Thus, the total cost of undernutrition (TCU) is a function of higher health-care spending (HCU), inefficiencies in education (ECU) and lower productivity (PCU). As a result, to account for the total cost (TCU), the function can be written as:

$$TC^U = f(HC^U, EC^U, PC^U)$$

In the area of health, the high probability resulting from the epidemiological profile of individuals suffering from undernutrition proportionally increases the costs in the health care sector (HSCU). In aggregate, this is equal to the sum of the interactions between the probability of undernutrition in each age group, the probability that a particular group will suffer from the diseases because of undernutrition, and the costs of treating the pathology (HSCU) that typically includes diagnosis, treatment and control. To these are added the costs paid by individuals and their families as a result of lost time and quality of life (IHCU). Thus, to study the variables associated with the health cost (HCU) the formula is:

$$HC^U = f(HSC^U, IHC^U)$$

In education, the reduced attention and learning capacity of those who have suffered from child undernutrition increase costs to the educational system (ESCU). Repeating one or more grades commensurately increases the demand that the educational system must meet, with the resulting extra costs in infrastructure, equipment, human resources and educational inputs. In addition, the private costs (incurred by students and their families) derived from the larger quantity of inputs, external educational supplementation and more time devoted to solving or mitigating low performance problems (IECU) are added to the above costs. Thus, in the case of the education cost (ECU), the formula is:

$$EC^U = f(ESC^U, IEC^U)$$

The productivity cost associated with undernutrition is equal to the loss in human capital (HK) incurred by a society, stemming from a lower educational level achieved by malnourished individuals (ELCU), a lower productivity in manual labour experienced by individuals who suffered from stunting (MLCU) and the loss of productive capacity resulting from a higher number of deaths caused by undernutrition (MMCU). In the model these costs are reflected as losses in potential productivity (PCU). Thus:

$$PC^U = f(ELC^U, MLC^U, MMC^U)$$

As a result, in order to comprehensively analyse the phenomenon of undernutrition, the model considers its consequences on health, education and productivity by translating them into costs.

2.1.4 Dimensions of analysis

Considering that a country's undernutrition situation and the consequences thereof reflect a specific epidemiological and nutritional transition process, a comprehensive analysis involves estimates of the current situation extrapolated from previous transitional stages as well as estimates of the future to predict potential cost and saving scenarios based on prospective interventions to control or eradicate the problem.

On this basis, a two-dimensional analysis model has been developed to estimate the costs arising from the consequences of child undernutrition in health, education and productivity:

Incidental retrospective dimension focuses on the population in the study year, including mortality cases of those who would have been alive in the study year. The retrospective dimension estimates the nutritional situation of individuals under the age of five to identify the related economic costs in the study year. Thus, it is possible to estimate the health costs of pre-school boys and girls who suffer from undernutrition during the year of analysis, the education costs stemming from the children

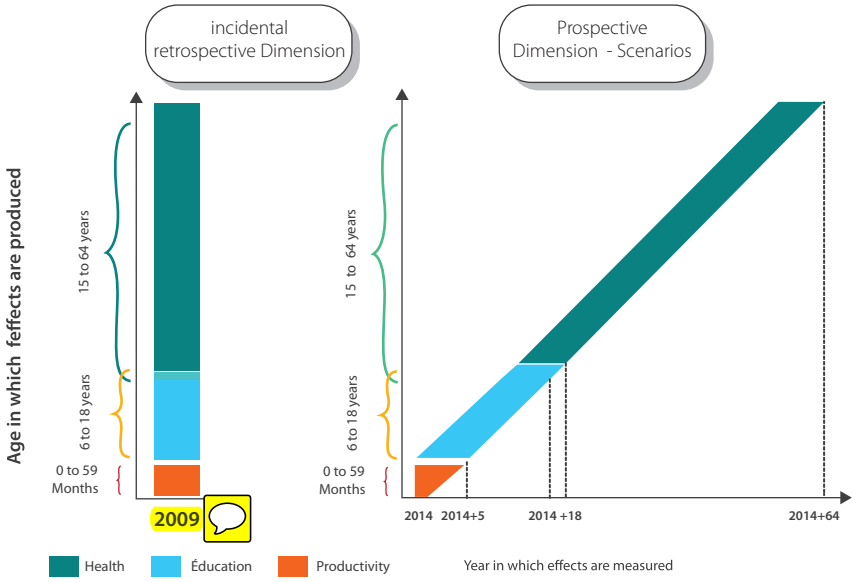
28 Rodrigo Martínez and Andrés Fernández, Model for Analysing the Social and Economic Impact of Child Undernutrition in Latin America (Santiago de Chile: Naciones Unidas, CEPAL, Social Development Division, 2007).

currently in school who suffered from undernutrition during the first five years of life, and the economic costs due to lost productivity by working-age individuals who were exposed to undernutrition before the age of five.

Prospective or potential savings dimension. This dimension focuses on children under five in a given year and allows analysis of the present and future losses incurred as a result of medical treatment, repetition of grades in school and lower productivity. Based on this analysis, potential savings derived from actions taken to achieve nutritional objectives can be estimated.

As shown in Figure 3, the incidental retrospective dimension includes the social and economic consequences of undernutrition in a specific year (for the purposes of this report, 2009 was set as the base year) for cohorts that have been affected (0 to 4 years of age for health, 6 to 18 years for education and 15 to 64 years for productivity). The prospective dimension on the other hand, projects the costs and effects of undernutrition recorded in the reference year of the study. These are based on the number of children born during the period selected in the analysis and, with the application of a discount rate, on the present value estimates of future costs to be incurred due to the consequences of undernutrition. The prospective dimension is the basis for establishing scenarios to estimate the economic and social savings of an improved nutritional situation.

FIGURE 3: DIMENSIONS OF ANALYSIS BY POPULATION AGE AND YEAR WHEN EFFECTS OCCUR



Source: Rodrigo Martinez and Andrés Fernández, Model for analysing the social and economic impact of child undernutrition in Latin America (see footnote) based on consultations carried out by authors. [29]

2.1.5 Methodological aspects

The analysis focuses on undernutrition during the initial stages of the life cycle and its consequences throughout life. This limits the study to the health of the foetus, the infant and the pre-schooler, i.e. those aged 0 to 59 months.[30] Similarly, the effects on education and productivity are analysed in the other demographic groups, i.e. 6-18 years old and 15-64 years old, respectively.

The population of children suffering from undernutrition was divided into sub-cohorts (0 to 28 days, 1 to 11 months, 12 to 23 months and 24 to 59 months) in order to highlight the specificity of certain effects during each stage of the life cycle.

The study uses undernutrition indicators that are measurable and appropriate to the different stages of an individual's life cycle. For intrauterine undernutrition, low birth weight (LBW) due to intrauterine growth restriction (IUGR, defined as a weight below the tenth percentile for gestational age) is estimated. For the pre-school stage, moderate and severe stunting categories (weight-for-height scores below -2 standard deviations) are used, with reference, where possible, to the World

29 Rodrigo Martínez and Andrés Fernández, Model for Analysing the Social and Economic Impact of Child Undernutrition in Latin America (Santiago de Chile: Naciones Unidas, CEPAL, Social Development Division, 2007).

30 In the original design, the idea of analysing direct information on the nutritional and health situation of pregnant women was considered, but the lack of reliable information on the incidence of undernutrition led to its exclusion from the analysis.

Health Organization (WHO) distribution for comparison purpose.[31]

Estimates of the impacts of undernutrition on health, education and productivity are based on the concept of the relative (or differential) risk run by individuals who suffer from undernutrition during the first stages of life as compared to a healthy child. This is valid both for the incidental-retrospective analysis and for the prospective-savings analysis; however, as its application has specific characteristics in each case, they are detailed separately in this document.

To estimate the costs for the incidental retrospective dimension, the values occurring in the year of analysis are totalled based on estimates of differential risks undergone by the different cohorts of the population. In the prospective analysis on the other hand, a future cost flow is estimated and updated (to present value).

The methodological approach presented here considers the most detailed and complete set of causes and effects of child undernutrition. Further, consideration has been made to ensure that certain causes and effects are not overemphasized or double counted. The methodological framework is based on strong research as well as institutional support from international organizations, and has been deemed a strong basis for the purpose of the research described in this report.

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31 In the estimation of stunting, a complementary analysis is done based on NCHS Standard in order to estimate the relative risk of lower productivity.

III Section

Brief Socio-Economic and Nutritional Background

Section III: Brief Socio-Economic and Nutritional Background

3.1 Country Background

3.1.1 Brief Socio-Economic Background

Sudan, the third largest country in Africa, with land area of 1.9 million square kilometres, traversed by the Nile and its tributaries. Sudan shares its borders with Southern Sudan, Central African Republic, Chad, Libya, Egypt, Eritrea and Ethiopia. It has access to the Red Sea with 853 kilometres long coastline. Its terrain is generally flat, featureless plain, mountains in northeast and west, while desert dominates the north.

Sudan's climate is tropical in the south, arid desert to the north, and the rainy season varies by region from April to November. With periodic persistent droughts and flooding, the country faces soil erosion and desertification and inadequate supplies of potable water. Its geography and ecology contribute to the shaping of health, nutrition and population situation, while vast distances, poor roads, and transport infrastructure affect the access to and coverage of health services.

Sudan comprises 18 states each divided into localities, which in total are 184, but varies with time due to redrawing the boundaries of the existing ones. Sudan with its multiparty system is a federated republic with powers devolved to states under Local Government Act (2003), often referred to as the Decentralization Act. However, precise legislative and organizational arrangements may vary from state to state.

FIGURE 4: SUDAN'S MAP

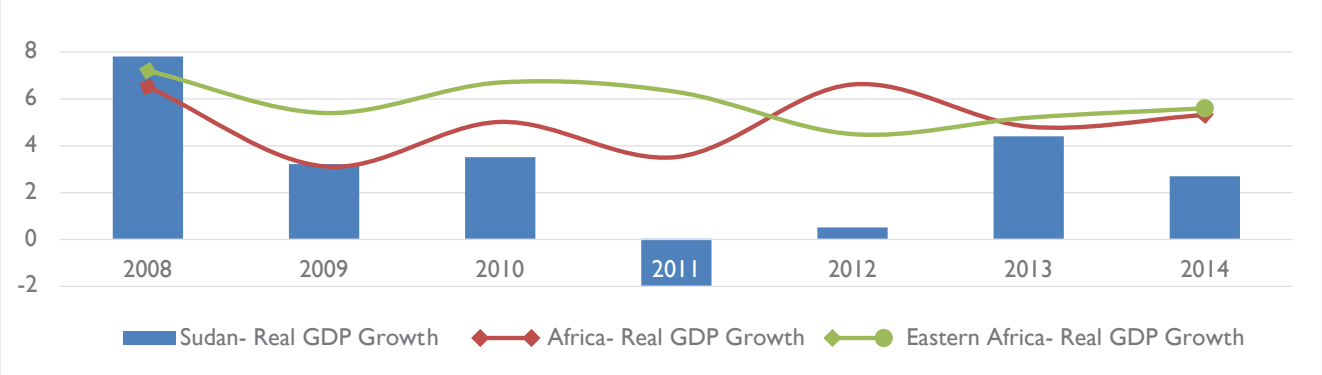
TABLE 3: SUDAN'S SOCIO-ECONOMIC INDICATORS

Indicators	2005	2010	2014	2018
GDP, total in billions of [Current USD]	26.5	65.6	82.2	40.9
GNI per capita (atlas method current USD)	590	1260	1820	1560
Population below the national poverty line (%)	-	46.5	36.1	
GINI Index (%)	…	35.4		
Unemployment, % of total labour force/	14.8	12.8	12.8	12.9
Unemployment, youth total (% of total labour force ages 16-24) [b/]	31.7	27	26.98	26.7
Population annual growth rate (%)	2.4	2.2	2.4	2.4
Life expectancy at birth, total (years)	60.4	62.6	64	65

Source if not otherwise noted: World Bank Database

Economically, Sudan was categorized as middle-income country (2,899 US$ GDP per capita in 2017). However, in 2018 the country economy went through sever financial crises manifested in the high inflation rates (more than 60 percent in 2018), devaluation of the national currency with scarcity in hard cash and the GDP per capita fell to 977 USD which recategorized Sudan as Low-income country[32].

FIGURE 5:TRENDS IN REAL GDP GROWTH, 2008-2014 *(IN PERCENTAGES)*



Source: "World Bank Database"

Public investment in the social sector has also been maintained in the last decade, but is still below the average, by proportion, compared to the sub-Saharan Africa region. Public spending in education is estimated at 10.8 percent (2009), which ranks below the regional average of 18.8 percent. Health expenditures are 5.6 percent of GDP, compared to 4.99 percent for the rest of region.

TABLE 1.2 SOCIAL INVESTMENT INDICATORS

Indicators	2005-2006	2008-2009	2014	Sub-Saharan Africa*
Public spending on education, total (% of gov. exp.)	8.3	10.8		18.8
Public spending on education, total (% of GDP)	1.96	2.2		
Health expenditure per capita (current USD)			132.3	91.5
Health expenditure, total (% of GDP)		6.2	5.6	4.9
Health expenditure, public (% of total health expenditure)		28.9	14.95	34.6

Source: World Bank Database, National Health Accounts 2008; 2015

Sudan with an increasingly ageing population faces a double burden of disease with rising rates of Communicable and Non-Communicable Diseases (C&NCDs). Sudan Multiple Indicator Cluster Survey (MICS) 2014, showed that 29 percent of children aged 5 to 59 months had diarrhoea, while 17.8 percent were sick due to suspected pneumonia in the two weeks prior to the survey. Protein energy malnutrition and micronutrient deficiencies remain a major problem among children under five, with 12 percent and 18.2 percent suffering from severe underweight and stunting, respectively. The most common micronutrient deficiencies are iodine, iron and vitamin A.

The enrolment of children has increased in primary education to 86.1 percent in 2017 (956,911 students). Moreover, the enrolment at secondary level has increased to reach 40.2 percent of the population at age of secondary schooling, although 233 secondary school were newly established in 2017.

32 World Bank

The main challenge facing education sector in Sudan is the low financing especially from the public sector. The households took the main burden of financing the education process of their children. In 2015, the government expenditure on education represent 1.3 percent of the GDP. Furthermore, the education sector in Sudan faces other challenges include high dropout rates, poor schools' environment, shortage of qualified teachers and the high number of children out of school (estimated more than 3 million).

According to the last survey of labour force in 2011, the size of labour force is about 9 million, with 7.5 employed and 1.7 unemployed, given that unemployment rate 18.5 percent, of which 41.1 percent are from population (+15 year) for both sex, 61.4 for male & 19.6 for female. Economic participation rate for both sex 50.5 male 70 percent, female 29 percent. Employment status 40.1 employee, 5.5 has his own job (on account), and self-employed about 39 percent.

The labour force according to economic activity 45.7 percent in agriculture sector, in mining and querying 1.3 percent, manufacturing 7.3 percent, 0.6 as manager labour force according to education, 7 percent professional, 3 percent technician, about 35 percent from labour force are illiterate.

3.1.2 Food and Nutrition Country Background

An estimated 40,050 Sudanese children under-5 years of age die every year as a direct or indirect result of undernutrition, using the conservative global estimate of 45 percent of child deaths attributable to undernutrition; this represents 120 children per day[33]. Sudan's undernutrition is associated with multiple factors, including conflict, poverty, challenging Agro-ecological conditions and the current economic situation in the country, leading to increased food prices, in addition to poor access to clean drinking water and health services.

The nutrition situation in Sudan has been characterized by persistently high levels of undernutrition since 1987. In 2014, 38.2 percent of children under five years of age are stunted. The national prevalence rate of Global Acute Malnutrition (GAM) at 16.5 percent,[34] places Sudan above the emergency threshold according to WHO criteria. About 2.3 million children suffer from wasting annually: Approximately 693,924 in 2014 were suffering from Severe Acute Malnutrition (SAM) and around 1.5 million children suffer from Moderate Acute Malnutrition (MAM) out of whom only 250,000 SAM and 366,000 MAM children are targeted by the outpatient therapeutic and supplementary feeding programmes. The expected inpatient SAM cases are around 96,494 for 2018[35]. However, the 2018 Humanitarian Response Plans (HRP) targeted only 50 percent of the caseload.

Despite substantial attention to the provision of treatment services in the conflict-affected states over the years, the majority (52 percent) of Sudan's acutely malnourished children live in nine non-conflict affected states[36], where the response has been inconsistent. The stagnation in the prevalence of all forms of malnutrition is an indication that different ways of working are needed. Maternal nutrition is also a concern, with some 208, 391 pregnant and lactating women (PLW) being undernourished every year (measured by Mid-Upper Arm Circumference (MUAC) < 23 cm), while the prevalence of low birth weight is 32.3 percent[37]. Additionally, while recent prevalence data is lacking, there is a high risk of micronutrient deficiency: the 2014 Multiple Indicator Cluster Survey (MICS) indicated only 7.6 percent of households consumed iodized salt.

The percentage of overweight and obese adults aged 18-69 years is 28.3 percent with 22.2 percent among males and 35.5 percent among females[38]. The burden of non-communicable diseases (NCDs) is on the rise alongside high rates of infectious diseases. A 2016 survey found that NCDs accounted for a total of 44 percent of the overall adult mortality in the country.

33 Sudan Nutrition Investment Case 2016.

34 MICS 2014 and 3SM 2013.

35 S3M prevalence for SAM

36 Red Sea, Kassala, Gezira, Khartoum, Northern, River Nile, Gadarif, Sinnar and White Nile

37 MICS 2014

38 Sudan Stepwise Survey 2016

TABLE 6: NUTRITION MAIN INDICATORS IN SUDAN

INDICATORS	Value
Prevalence of wasting among children < 5 years (GAM) (%)	16.3%
Prevalence of severe wasting among children < 5 years (SAM)	4.5%
Prevalence of stunting among children < 5 years	38.2%
Prevalence of underweight among children < 5 years	33%
Prevalence of overweight among children < 5 years	3%
Prevalence of low birth weight infants	32.3%
Population using improved drinking-water sources	62%
Population using improved sanitation facility	25.4%
Anemia among pregnant women	34.1%
Anemia among non-pregnant women	30.4%
Early initiation of breastfeeding	68.7%
Exclusive breastfeeding	55.4%
Minimum acceptable diet (breastfed children)	25%
Consumption of iodized salt	7.6%
Births in baby-friendly facilities	5.9%

Source: MICS 2014

3.2 Effects and Costs of Child Undernutrition in Sudan

Undernutrition is mainly characterized by wasting - a low weight-for-height, stunting - low height-for-age and underweight - low weight-for-age. In early childhood, undernutrition has negative life-long and intergenerational consequences; undernourished children are more likely to require medical care as a result of undernutrition-related diseases and deficiencies.[39] This increases the burden on public social services and health costs incurred by the government and the affected families. Without proper care, underweight and wasting in children results in a higher risk of mortality.[40] During schooling years, stunted children are more likely to repeat grades and drop out of school,[41] thus reducing their income-earning capability later in life.[42] Furthermore, adults who were stunted as children are less likely to achieve their expected physical and cognitive development, thereby impacting on their productivity.[43]

The recent improvement in poverty rates has been accompanied by a reduction in child undernutrition, particularly in stunting. According to the 2014 Multiple Indicator Cluster Surveys (MICS), approximately 38.2 percent of Sudanese children under the age of 5 were suffering from low height for their age (stunting), which is a slight reduction from the 43.3 percent reported by MICS in 2000. The prevalence of underweight children has also improved from 40.7 percent to 33 percent. For that same period, the level of low birth weight prevalence in children has also remained steady, at around 10 percent.[44]

39 WHO, Fact Sheets on Malnutrition, https://www.who.int/news-room/fact-sheets/detail/malnutrition.

40 Myatt et al, Children who are both wasted and stunted are also underweight and have a high risk of death: a descriptive epidemiology of multiple anthropometric deficits using data from 51 countries, Archives of Public Health (2018) 76:28.

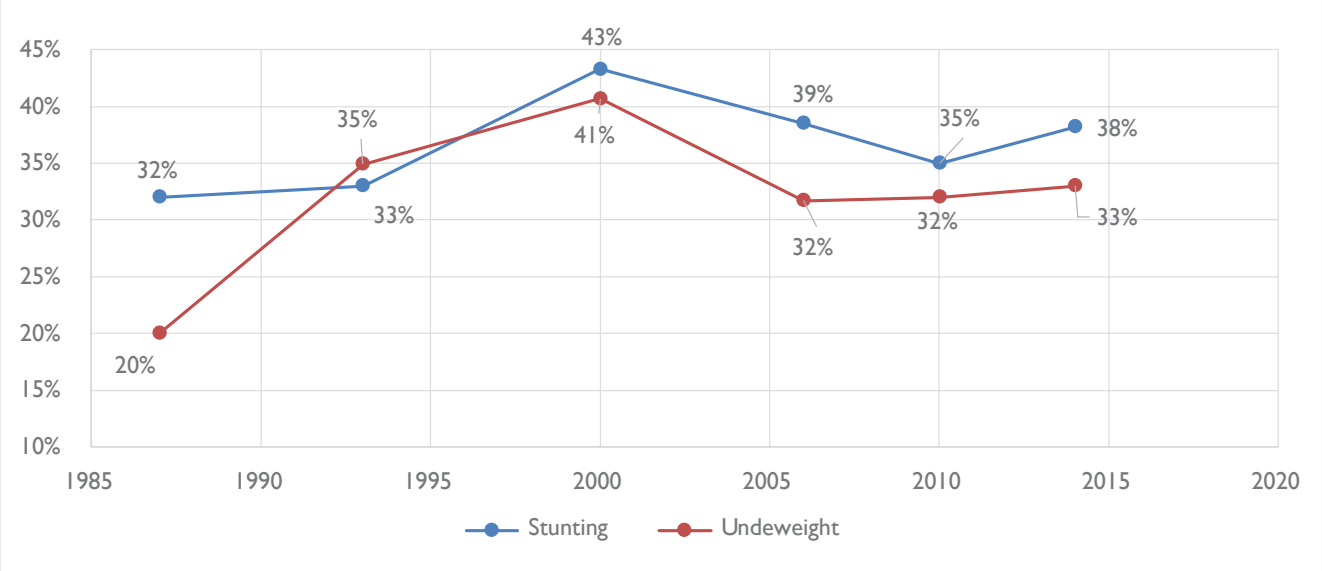
41 Short stature and the age of enrolment in Primary School: studies in two African countries, Scientific Coordinating Centre, Partnership for Child Development, Welcome Trust Centre for the Epidemiology of Infectious Disease, University of Oxford, South Parks Road, Oxford OX1 3PS, UK.

42 Ibid.

43 M. de Onis and F. Branca, Childhood stunting: a global perspective, Review Article, Maternal & Child Nutrition (2016),12(Suppl. 1), pp. 12–26..

44 MICS 2000 and 2014.

FIGURE 6: ESTIMATED UNDERNUTRITION TRENDS IN CHILDREN UNDER-FIVE, 1987-2014 *(IN PERCENTAGES)*



Source: World Health Organization report 1987, World Health Organization report1993, MICS 2000, Sudan Household Health Survey 2006, Sudan household Survey 2010, MICS 2014.

The current levels of child undernutrition illustrate the continuing challenges for reduction of child hunger. It is estimated that out of 6,414,478 under age of five in 2014, 2.4 million were stunted and 2.1 million children are the underweight in Sudan. This situation is especially critical for children between 24 and 59 months, where 45.5 percent of children are affected by stunting.

TABLE 7: POPULATION AND CHILD UNDERNUTRITION, 2014

Age groups	Population size (2014) a/	Low Birth Weight		Underweight		Stunting	
		Population affected (2014)	Prevalence (2014) b	Population affected (2014)	Underweight prevalence (2014) b/	Population affected (2014)	Stunting prevalence (2014) b/
New-born (IUGR)a		458,960	33.0%				
0-11 months	1,390,787			259,107	18.6%	217,074	15.6%
12-23 months	1,319,804			468,064	35.5%	534,348	40.5%
24-59 months	3,703,887			1,402,120	37.9%	1,684,210	45.5%
Total	**6,414,478**	**458,960**	**33.0%**	**2,129,291**	**30.3%**	**2,435,632**	**38.2%**

Source: MICS 2014.

3.2.1 Social and economic cost of child undernutrition in the health sector

Undernutrition at an early age predisposes children to higher morbidity and mortality risks.[45] The risk of becoming ill due to undernutrition has been estimated using probability differentials, as described in the methodology. Specifically, the study has examined medical costs associated with treating Low Birth Weight (LBW), underweight, anaemia, Acute Respiratory Infections (ARI), Acute Diarrheal Syndrome (ADS), and fever/malaria associated with undernutrition in children under the age of five.

45 Boah M, Azupogo F, Amporfro DA, Abada LA (2019) The epidemiology of undernutrition and its determinants in children under five years in Ghana, PLoS ONE 14(7): e0219665.

3.2.1.1 Effects on Morbidity

Undernourished children are more susceptible to recurring illness.[46] Based on the differential probability analysis undertaken with DHS data in Sudan, underweight children under 5 years have an increased risk of anaemia (increased risk equal to 17.5 percentage points), an increased risk of diarrhoea (increased risk equal to 5.4 percentage points) and an increased risk of respiratory infection (increased risk equal to 2.0 percentage points),

The study estimated that in Sudan in 2014, there were 2,831,647 incremental episodes of illness related to diseases associated with underweight. In addition, pathologies related to calorie and protein deficiencies and low birth weight associated with Intrauterine Growth Restriction (IUGR), totalled more than 346,267 episodes in 2014.

TABLE 8: MORBIDITIES FOR CHILDREN UNDER-FIVE ASSOCIATED WITH UNDERWEIGHT, BY PATHOLOGY, 2014

Pathology	Number of episodes	Percentage of episodes
Anaemia	442,265	57.5%
ADS	10,303	1.3%
ARI	54,856	7.1%
Malaria	261,261	34.0%
Subtotal	**768,685**	
LBW	346,267	14.0%
Underweight	2,129,291	86.0%
Subtotal	2,475,558	
Total	**3,244,243**	

Source: Model estimations based on MICS 2014, Sudan Malaria indicator survey 2016

3.2.1.2 Stunting levels of the working age population

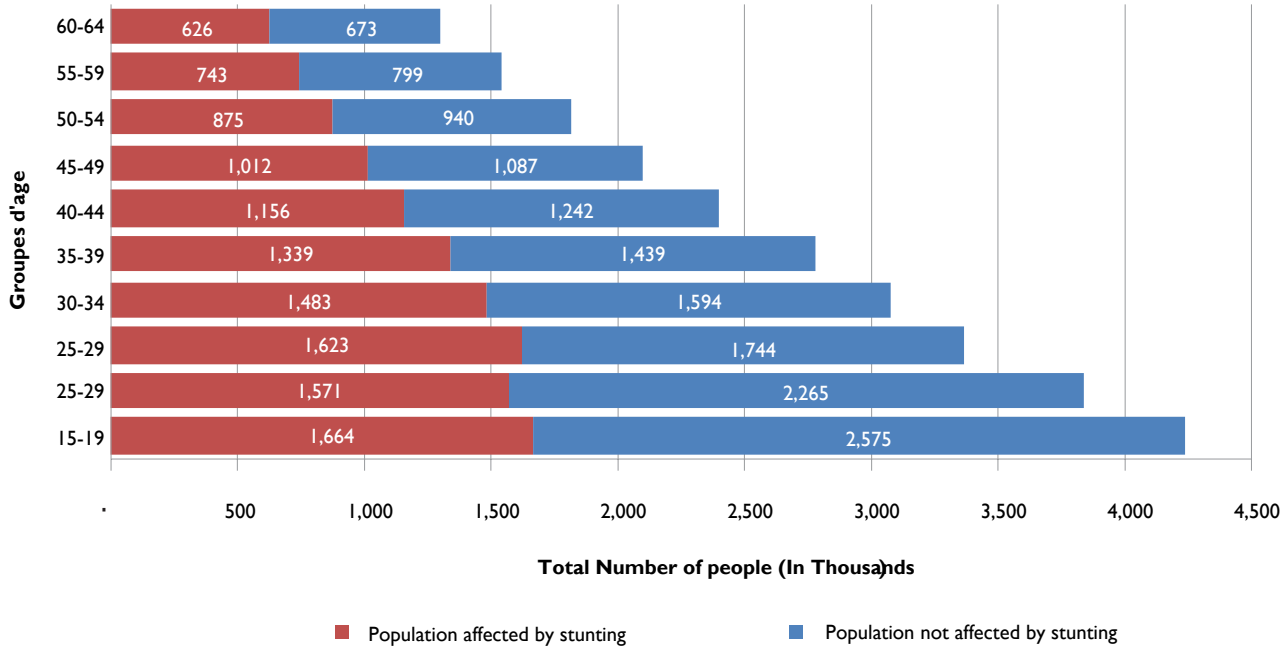
Undernutrition leads to stunting in children, which can impact on their productivity at later stages in life.[47] Sudan has made progress in reducing stunting in children; nevertheless, stunting rates still remain high.[48] As illustrated in Figure 2.3, the model estimated that 12.1 million adults in the working-age population suffered from growth retardation before reaching five years. In 2014 this represented 45.7% of the population aged 15-64 who were in a disadvantaged position as compared to those who were not undernourished as children.

46 Judd LW and James AB, The impact of malnutrition on childhood infections, Current Opinions in Infectious Diseases. 2018 Jun; 31(3): 231–236.

47 MICS 2014.

48

FIGURE 7: WORKING AGE POPULATION AFFECTED BY CHILDHOOD STUNTING, BY AGE
(IN MILLIONS OF PEOPLE)



Source: Model estimations based on demographic information and WHO/NCHS database.

3.2.1.3 Effects on mortality

Child undernutrition can lead to increased cases of mortality most often associated with incidences of diarrhoea, pneumonia and malaria.[49] Nevertheless, when the cause of death is determined, it is rarely attributed to the nutritional deficit of the child, but rather to the related illnesses. Given this limitation in attribution, the model utilizes relative risk factors to estimate the risk of increased child mortality as a result of child undernutrition. Mortality risk associated with undernutrition was calculated using these relative risk factors, historical survival and mortality rates, and historical nutrition information.

In the last 5 years alone, it is estimated that 172,866 child deaths in Sudan were directly associated with undernutrition. These deaths represent 37.7 percent of all child mortalities for this period. Thus, it is evident that undernutrition significantly exacerbates the rates of death among children and limits the country's capacity to achieve the SDGs, especially goal 3 which is good health and wellbeing to reduce child mortality.

TABLE 2.5 IMPACT OF UNDERNUTRITION ON CHILD MORTALITY, ADJUSTED BY SURVIVAL RATE, 1950-2014
(IN NUMBER OF MORTALITIES)

Period	Number of child mortalities associated to undernutrition
1948-1999	1,077,671
2000-2009	302,752
2010-2014	172,866
Total	1,553,290

Source: ECA on the basis of life tables provided by UN Population Division

49 Laura E Caulfield, Mercedes de Onis, Monika Blössner, and Robert E Black, Undernutrition as an underlying cause of child deaths associated with diarrhoea, pneumonia, malaria, and measles, American Journal of Clinical Nutrition, 2004;80:193– 8

These historical mortality rates will also have an impact on national productivity. The model estimates that an equivalent of 5.2 percent of the current workforce has been lost due to the impact of undernutrition in increasing child mortality rates. This represents 1,077,671 people who would have between 15-64 years old, and part of the working age population of the country.

3.2.1.4 Estimation of public and private health costs

The treatment of undernutrition and related illnesses is a critical recurrent cost for the health system. Treating a severely underweight child for example, requires a comprehensive protocol[50] that is often more costly than the monetary value and effort needed to prevent undernutrition. The economic cost of each episode is often increased by inefficiencies when such cases are treated without proper guidance from a health-care professional or due to lack of access to proper health services. These costs generate a significant important burden not just to the public sector but to society as a whole.

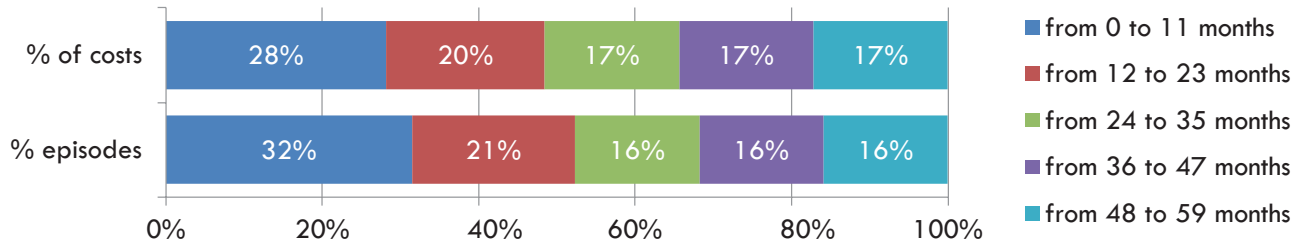
It is estimated that 3,244,243 clinical episodes in Sudan in 2014, were associated with the higher risk present in underweight children. As indicated in Table 2.6, these episodes generated an estimated cost of SDG 4,616 Million.

TABLE 10: HEALTH COSTS OF UNDERNUTRITION-RELATED PATHOLOGIES, 2014

Pathology	% of episodes	% of cost	Cost (millions of SDG])	Cost (thousands of USD)
Underweight	65.3%	67.8%	3,130.5	542.7
Low birth weight (IUGR)	10.6%	15.1%	696.8	120.8
Anaemia	13.6%	9.0%	415.6	72.0
Acute diarrheal syndrome (ADS)	0.3%	0.2%	7.8	1.3
Acute respiratory infection (ARI)	2.2%	1.9%	88.8	15.4
Fever/Malaria	8.0%	6.0%	276.5	47.9
Total	**100%**	**100%**	**4,615.9**	**800.1**

Source: Model estimations based on MICS 2014, Sudan Malaria indicator survey 2016

Most of these costs incurred were associated with the protocol required to bring an underweight child back to a proper nutritional status, which often requires therapeutic feeding.[51] An important element to highlight is the particular costs generated by the treatment of low birth weight children. These cases represented 10.62 percent of all the episodes but generated 15 percent of the total cost. This is due to the special management protocol required by LBW children which often includes hospitalization and time in intensive care.



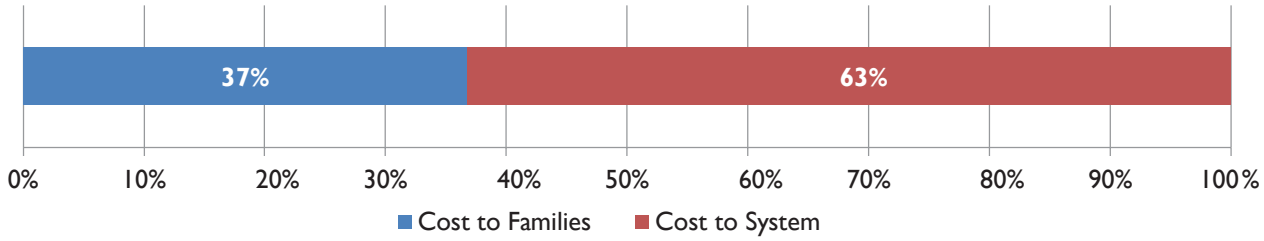
Source: Model estimations based on DHS 2010, and demographic information

A large proportion of costs related to undernutrition are borne by families as these children are often not provided with proper health care. Based on the information collected by the NIT, the model estimated that only 29.9 percent of the episodes presented receive proper health care. As explained in the methodology section of this report, medical costs incurred in a treatment facility are used as shadow costs to estimate the burden borne by families. Figure 9 summarizes the institutional (public system) and costs to caretakers of treating pathologies associated with undernutrition. In Sudan, it is estimated that families bear around 37 percent of the costs associated with undernutrition, while the cost to the health system was 63 percent.

50 WHO, Management of severe malnutrition: a manual for physicians and other senior health workers ISBN 92 4 154511 9, NLM Classification: WD 101, 1999.

51 http://www.thousanddays.org/

FIGURE 9: DISTRIBUTION OF PRIVATE AND PUBLIC COSTS (IN PERCENTAGES)



Source: Model estimations based on demographic information and WHO/DHS nutritional surveys.

Although the families of undernourished children incur most of the health costs related to undernutrition, the burden of this phenomenon is still an important expenditure component in the public sector. In 2014, the annual estimated cost to the public sector was equivalent to 67.9 percent of the total budget allocated to health. On the whole, the economic impact of undernutrition in health-related aspects was equivalent to 1.0 percent of the GDP in 2014.

3.2.2 Social and economic cost of child undernutrition in the education sector

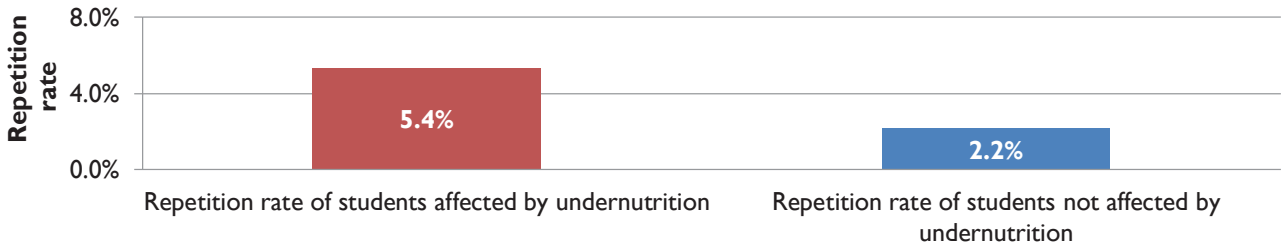
(There is no single cause for repetition and dropout; however, there is substantive research that shows that students who were stunted before the age of 5 are more likely to underperform in school.[52] The number of repetition and dropout cases considered in this section result from applying a differential risk factor associated to stunted children to the official government information on grade repetition and dropouts in 2014. The cost estimations are based on information provided by the Ministry of Education on the average cost of a child to attend primary and secondary school in Sudan in 2014, as well as estimations of costs incurred by families to support schooling.

3.2.2.1 Effects on repetition

Children who suffered from undernutrition before 5 years of age are more likely to repeat grades, compared to those were not afflicted by undernutrition.[53] In Sudan in 2014, enrolment rates were relatively high, with more than 70 percent enrolment in primary education and more than 42 percent enrolment in secondary education.[54]

Based on official information provided by the Ministry of Education, 218,533 children repeated grades in 2014. Using data on increased risk of repetition among stunted students, the model estimated that the repetition rate for stunted children was 5.4 percent, while the repetition rate for non-stunted children was 2.2 percent. Thus, given the proportion of stunted students, the model estimates that 63,215 students, or 28.9 percent of all repetitions in 2014 were associated with stunting.

FIGURE 10: REPETITION RATES IN EDUCATION BY NUTRITIONAL STATUS, 2014 *(IN PERCENTAGES)*



Source: Estimations based on data provided by Ministry of Education

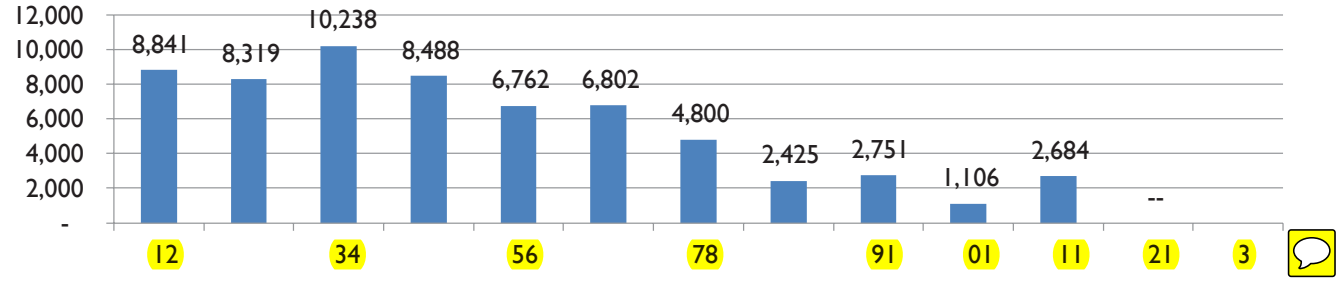
52 Melissa C. Daniels and Linda S. Adair, "Growth in young Filipino children predicts schooling trajectories through high school," The journal of Nutrition, March 22, 2004, pp. 1439-1446, accessed September 11, 2012, Jn.nutrition.org

53 Melissa C. Daniels and Linda S. Adair, "Growth in young Filipino children predicts schooling trajectories through high school," The journal of Nutrition, March 22, 2004, pp. 1439-1446, accessed September 11, 2012, Jn.nutrition.org.

54 Ministry of Education, Annual Statistical Report, MICS 2014.

As shown in Figure 11, most of these grade repetitions happen during the primary school. There are far fewer children who repeat grades during secondary school; this largely due to the fact that many underperforming students would have dropped out of school before reaching secondary education.

FIGURE 11: GRADE REPETITION OF STUNTED CHILDREN, BY GRADE, 2014



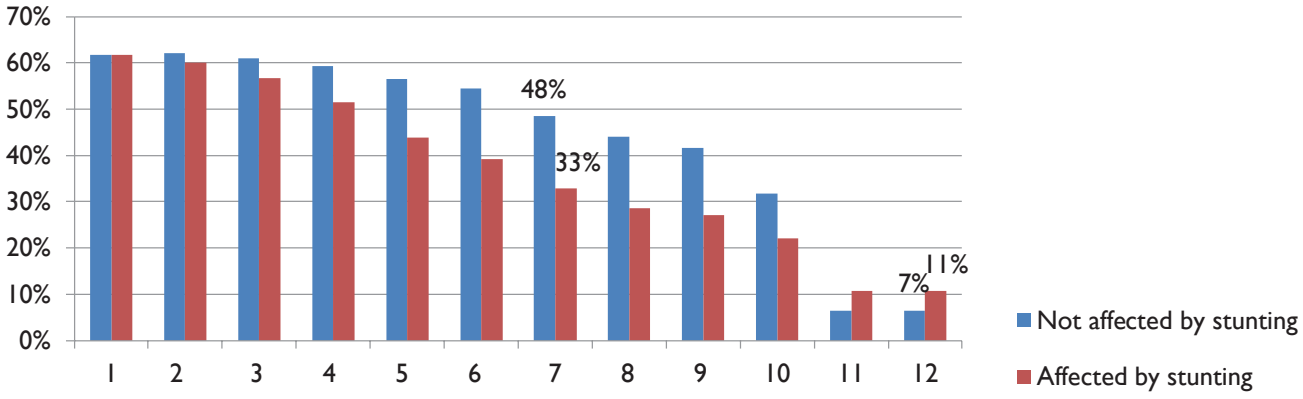
Source: Estimations based on data from Ministry of Education.

3.2.2.2 Effects on retention

Research shows that students who were stunted as children are more likely to drop out of school.[55] According to available data and taking into account relative risks relating to the consequences of stunting on education, it is estimated that only 31.7 percent of stunted people (of working age) in Sudan completed primary school compared to 50.1 percent of those who were never stunted.

The costs associated with school dropouts are reflected in the productivity losses experienced by individuals searching for opportunities in the labour market. As such, the impact is not reflected in the school age population, but in the working-age population. Hence, in order to assess the social and economic costs in 2014, the analysis focuses on the differential in schooling levels achieved by the population who suffered from stunting as children and the schooling levels of the population who was never stunted.

FIGURE 2.8 GRADE ACHIVEMENT BY NUTRITIONAL STATUS, 2014 *(IN PERCENTAGES)*



Source: Estimations based of data provided by NIT

55 Senbanjo IO et al., Prevalence of and Risk factors for Stunting among School Children and Adolescents in Abeokuta, Southwest Nigeria. Journal of Health, Population and Nutrition, 2011 Aug;29(4):364-370

3.2.2.3 Estimation of public and private education costs

Repetition in schooling has direct cost implications for families and the school system. Students who repeat grades generate an incremental cost to the education system, as they require twice as many resources to repeat the year. In addition, the caretakers also have to pay for an additional year of education.

In 2014, the 63,215 students who repeated grades (and whose repetitions are considered to be associated with undernutrition) incurred a cost of SDG 140.2 million. The largest proportion of repetitions occurred during primary school, where the cost burden falls mostly on the public education system. The following chart summarizes the public and private education costs associated with stunting.

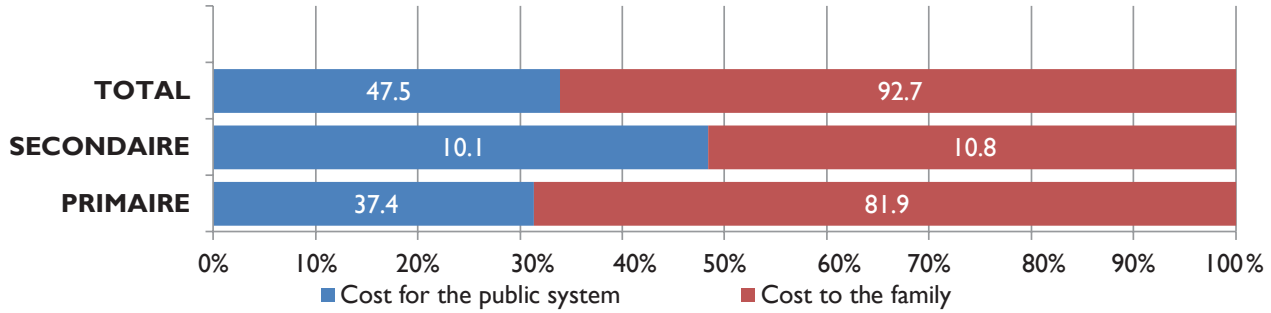
FIGURE 13: COSTS OF GRADE REPETITIONS ASSOCIATED WITH STUNTING *(IN MILLIONS OF SDG)*

	Primary		Secondary		Total	
	In SDG	In USD	In SDG	In USD	In SDG	In USD
Number of repetitions associated with stunting	**56,675**		**6,540**		**63,215**	
Public Costs per student	660.0	114.4	1,548.0	268.3		
Total Public Costs (in millions)	37.4	6.5	10.1	1.8	47.5	8.2
Private Costs per student	1,444.8	250.4	1,652.4	286.4		
Total Private Costs (in millions)	81.9	14.2	10.8	1.9	92.7	16.1
Total Costs	119.3	20.7	20.9	3.6	140.2	24.3
% Social expenditure on education	0.03%					

Source: Model estimations based on costing data from the Ministry of Education

As in the case of health, the social cost of undernutrition in education is shared between the public sector and the families. Of the overall costs, a total of SDG 92.7 million (66.1 percent) are being covered by the care takers, while SDG 47.5 million (33.9 percent) is borne by the public education system. Nevertheless, the distribution of this cost varies depending on whether the child repeated grades in primary or secondary education. In primary education, the families cover 68.4 percent percent of the associated costs of repeating a year, where as in secondary the burden on the families is reduced to 51.6 percent. In both cases, the households covered the larger proportion of the burden.

FIGURE 14: DISTRIBUTION OF COSTS IN EDUCATION *(IN PERCENTAGES AND MILLIONS OF [LOCAL CURRENCY])*



Source: Estimations based of data provided by NIT

3.2.3 Social and economic cost of child undernutrition in productivity

As described in the health section of the report, the model estimated that 42.6 percent of the working-age population in Sudan were stunted as children. Research shows that adults who suffered from stunting as children are less productive than non-stunted workers and are less able to contribute to the economy. This represents more than 12.1 million people whose potential productivity is affected by undernutrition.

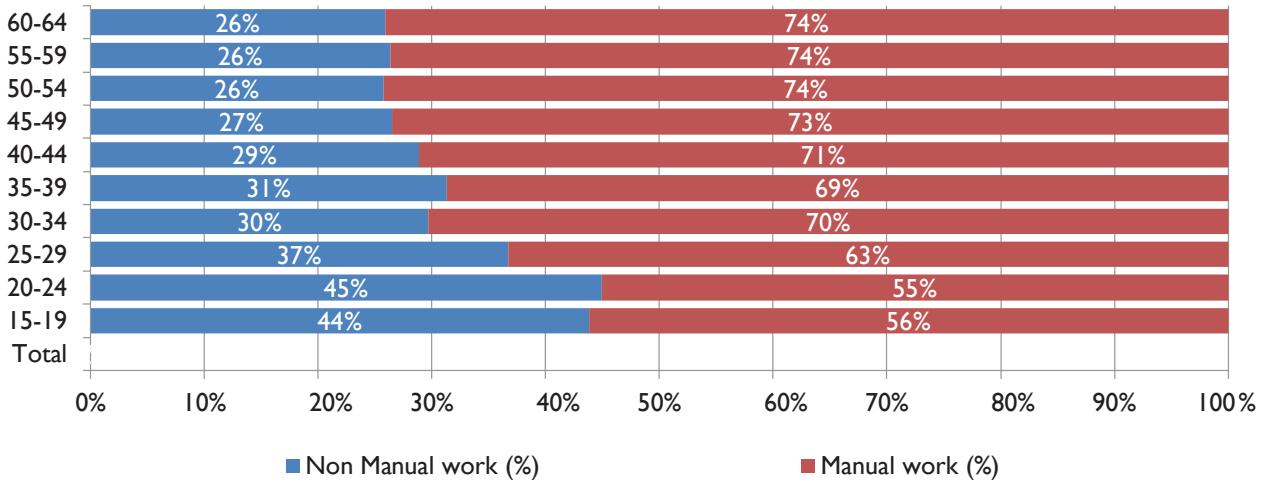
National productivity is significantly affected by historical rates of child undernutrition. Firstly, stunted people, on average, have achieved fewer years of schooling than non-stunted people.[56] In non-manual activities, higher academic achievement is directly correlated with higher income.[57] Research shows that stunted workers engaged in manual activities tend to have less lean body mass[58] and are more likely to be less productive in manual activities than those who were never affected by growth retardation.[59] Finally, the population lost due to child mortality hinders economic growth, as they could have been healthy productive members of the society.

The model utilizes historical nutritional information, in-country demographic projections, adjusted mortality rates, and data reported in the MICS Survey from 2014 to estimate the proportion of the population whose labour productivity is affected by childhood nutrition.

The cost estimates in labour productivity were estimated by identifying differential income associated with lower schooling in non-manual activities, as well as the lower productivity associated with stunted people in manual work, such as agriculture. The opportunity cost of productivity due to mortality is based on the expected income that a healthy person would have been earning, had he or she been part of the workforce in 2014.

The distribution of the labour market is an important contextual element in determining the impact of undernutrition on national productivity. As shown in Figure 15, 67.4 percent of the working age population is engaged in manual activities. The trend of manual labour seems to be lower for both younger groups: from 15 to 19 and 20 to 24, indicating that more non-manual jobs are becoming available for the youth in Sudan.

FIGURE 15: MANUAL AND NON-MANUAL LABOUR DISTRIBUTION, BY AGE, 2014 *(IN PERCENTAGES)*



56 Melissa C. Daniels and Linda S. Adair, "Growth in young Filipino children predicts schooling trajectories through high school, the journal of Nutrition, March 22, 2004, pp. 1439-1446, accessed September 11, 2012, Jn.nutrition.org

57 Remi Clignet, The Africanization of the Labour Market: Educational and Occupational Segmentation in the Cameron, California University Press, 1976

58 C. Nascimento et al., Stunted Children gain Less Lean Body Mass and More Fat Mass than Their Non-stunted Counterparts: A Prospective Study., report (Sao Paulo: Federal University of Sao Paulo, 2004)

59 Lawrence J. Haddad and Howarth E. Bouis, "The impact of nutritional status on agricultural productivity: wage evidence from the Philippines," Oxford Bulletin of Economics and Statistics 53, No. 1, February 1991, doc. 10.1111/j.1468-0084.1991.mp53001004.x.

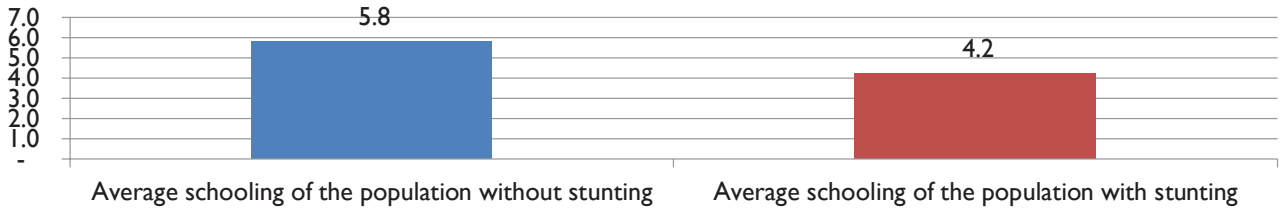
3.2.3.1 Loss from non-manual activities due to reduced schooling

As described in the education section of this report, students who were undernourished as children complete, on average, fewer years of schooling than students who were adequately nourished as children.[60] This loss in educational years has particular impact for people who are engaged in non-manual activities, in which a higher academic education represents a higher income.

Based on information from the Sudan Labour force survey 2011, and as shown in Figure 16, it is estimated that the educational gap between the stunted and non-stunted population is 1.6 years. It is important to note that over time there has been an improvement in the average years of schooling among the working population. Whereas the cohort from 60-64 years show and average level of school education of 1.8 years, the cohort aged 20-24 shows an average of 7.2 years of education.

FIGURE 16: AVERAGE SCHOOLING YEARS FOR STUNTED AND NON-STUNTED POPULATION

(IN YEARS OF EDUCATION)



Source: Labour force survey 2011

The lower educational achievement of the stunted population has an impact on the expected level of income a person would earn as an adult. As presented in Table 9, the model estimates that 6,055,543 people engaged in non-manual activities suffered from childhood stunting. This represents 29.5 percent of the country's labour force that is currently less productive due to lower schooling levels associated to stunting. The estimated annual losses in productivity for this group are SDG 1.018 billion (USD 176.5 million) equivalent to 0.23 percent of the GDP in 2014.

TABLE 11: REDUCED INCOME IN NON-MANUAL ACTIVITIES DUE TO STUNTING, 2014

Age in 2012	Population working in non-manual sectors who were stunted as children	Income loss in non-manual labour	
		millions of [SDG]	millions of USD
15-19	902,373	(158,9)	(27.5)
20-24	761,085	114.6	19.9
25-29	874,964	182.2	31.6
30-34	839,576	128.9	22.3
35-39	659,677	166.0	28.8
40-44	628,422	141.9	24.6
45-49	521,828	101.9	17.7
50-54	371,806	165.7	28.7
55-59	312,666	92.2	16.0
60-64	183,147	84.0	14.6
Total	6,055,543	1,018.5	176.5
% GDP	0.23%		

Source: Labour force survey 2011

60 Melissa C. Daniels and Linda S. Adair, "Growth in young Filipino children predicts schooling trajectories through high school," The Journal of Nutrition, March 22, 2004, pp. 1439–1446, accessed September 11, 2012, Jn.nutrition.org

3.2.3.2 Losses in manual activities

Manual activities are mainly observed in the agricultural, forestry and fishing subsectors, employing more than 67 percent of the Sudan population. Research shows that stunted workers engaged in manual activities tend to have less lean body mass[61] and are more likely to be less productive in manual activities than those who were never affected by growth retardation.[62]

The model estimated that 7.3 million people in Sudan are engaged in manual activities, of which 3.2 million were stunted as children. This represented an annual loss in potential income that surpasses SDG 655.9 million (USD 113.7 million), equivalent to 0.15 percent of the GDP in potential income lost due to lower productivity.

TABLE 12: LOSSES IN POTENTIAL PRODUCTIVITY IN MANUAL ACTIVITIES DUE TO STUNTING, 2014

Age in 2014	Population working in manual labour who were stunted as children	Income losses in manual labour	
		millions of [SDG]	millions of USD
15-19	704,377	141.0	24.4
20-24	620,769	122.2	21.21
25-29	506,879	89.5	15.5
30-34	354,875	66.0	11.4
35-39	300,960	58.7	10.2
40-44	254,563	58.7	10.2
45-49	188,383	44.7	7.7
50-54	128,889	33.1	5.7
55-59	111,726	29.4	5.1
60-64	63,920	12.6	2.2
Total	3,235,340	655.9	113.7
% GDP	0.15%		

Source: Labour force survey 2011

3.2.3.3 Opportunity cost due to mortality

As indicated in the health section of this report, there is an increased risk of child mortality associated with undernutrition.[63] The model estimated that 1,077,671 of working age were absent from Sudan's workforce in 2014 due to child mortality associated with undernutrition. This represents a 5.2 percent reduction in the current workforce.

Considering the productive levels of the population, by their age and sector of labour, the model estimated that in 2014, the economic losses (measured by working hours lost due to undernutrition-related child mortality) were SDG 5,196.3 million, which represented 1.2 percent of the country's GDP.

61 C. Nascimento et al., Stunted Children gain Less Lean Body Mass and More Fat Mass than Their Non-stunted Counterparts: A Prospective Study, report (Sao Paulo: Federal University of Sao Paulo, 2004).

62 Lawrence J. Haddad and Howarth E. Bouis, "The impact of nutritional status on agricultural productivity: wage evidence from the Philippines," Oxford Bulletin of Economics and Statistics 53, No. 1, February 1991, doi: 10.1111/j.1468-0084.1991.mp53001004.x.

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TABLE 13: LOSSES IN POTENTIAL PRODUCTIVITY DUE TO MORTALITY ASSOCIATED WITH UNDERNUTRITION, 2014

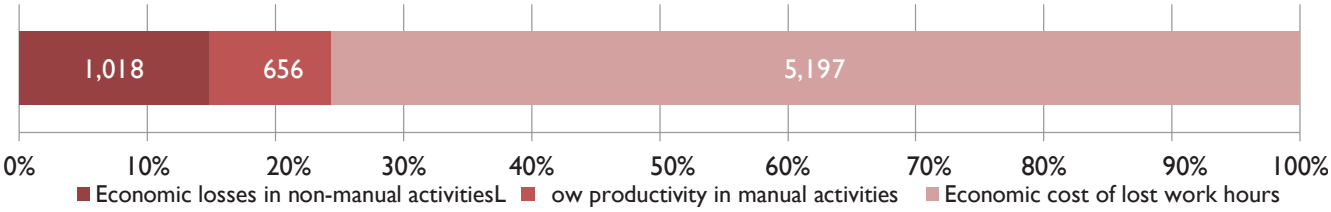
Age in 2014	Working Hours Lost due to Higher mortality of underweight children (in millions of hours)	Income losses due to mortality	
		millions of SDG	millions of USD
15-19	138,533	480.68	83.32
20-24	138,633	569.97	98.80
25-29	142,820	639.73	110.89
30-34	134,074	642.64	111.40
35-39	121,627	581.71	100.84
40-44	101,237	549.80	95.30
45-49	90,083	487.72	84.54
50-54	79,485	475.55	82.43
55-59	69,924	407.01	70.55
60-64	61,254	361.72	62.70
Total	1,077,671	5,196.54	900.79
% GDP	1.2%		

Source Labour force survey 2011

3.2.3.4 Overall Productivity Losses

The total losses in productivity for 2014 are estimated at approximately SDG 6.9 billion (USD 1.2 billion), which is equivalent to 1.5 percent of Sudan's GDP. As presented in Figure 17, the largest share of productivity loss is due to reduced productivity due to undernutrition-related mortality which represents 75.6 percent of the total cost. The lost productivity in non-manual activities represents 14.8 percent of the costs. The income differential in manual labour, due to the lower physical and cognitive capacity of people who suffered from growth retardation as children represents 9.5 percent of the total costs.

FIGURE 17: DISTRIBUTION OF LOSSES IN PRODUCTIVITY *(BILLIONS OF SDG)*



Source: Labour force survey 2011

3.3 Summary of Effects and Costs

The methodology is used to analyse the impact of child undernutrition in different stages of the life cycle, without generating overlaps. As a result, the individual sectoral costs can be aggregated to establish a total social and economic cost of child undernutrition.

For Sudan, the total losses associated with undernutrition are estimated at SDG 11.6 billion, or USD 2 billion for the year 2014. These losses are equivalent to 2.6 percent of GDP in 2014. The highest element in this cost is the loss in potential productivity as a result of undernutrition-related mortalities.

TABLE 14: SUMMARY OF COSTS, 2014

	Episodes	Cost in Billions of SDG	Cost in Millions of Dollars	Percentage of GDP
Heath Costs				
LBW and Underweight	2,475,558	3,8	663.4	
Increased Morbidity	768,685	0.8	136.7	
Total for Health	3,244,243	4.6	800.1	1.03%
Education Cost				
Increased Repetition - Primary	56,675	0.1	20.7	
Increased Repetition - Secondary	6,540	0.02	3.6	
Total for Education	63,215	0.14	24.3	0.03%
Productivity Costs				
Lower Productivity - Non-Manual Activities	6,055,543	1.0	176.5	
Lower Productivity - Manual Activities	3,235,340	0.7	113.7	
Lower Productivity - Mortality	1,077,671	5.2	900.8	
Total for Productivity		6.9	1,191.0	1.53%
TOTAL COSTS		**11.6**	**2,015.5**	**2.6%**

Source: Model estimations

IV Section

Analysis of Scenarios

Section IV: Analysis of Scenarios

Analysis of Scenarios

The previous chapter showed the social and economic costs that affected Sudan in 2014 due to high historical trends of child undernutrition. Most of these costs are already cemented in the society and policies must be put in place to improve the lives of those already affected by childhood undernutrition. Nevertheless, there is still room to prevent these costs in the future. Currently, one out of every two children under the age of five in Sudan is stunted[64].

This section analyses the impact that a reduction in child undernutrition could have on the socio-economic context of the country. The results presented in this section project the additional costs to the health and education sectors as well as losses in productivity that Sudan children would bear in the future. They also indicate potential savings to be achieved. This is a call for action to take preventive measures and reduce the number of undernourished children to avoid large future costs to the society.

The model generates a baseline that allows development of various scenarios based on nutritional goals established in each country using the prospective dimension. The generated outcomes can be used to advocate for increased investments in proven nutritional interventions. These scenarios are constructed based on the estimated net present value of the costs of children born in each year between 2014 – 2025 and 2014 – 2030. The methodology follows each group of children and, based on each scenario, estimates a progressive path towards achieving the set nutritional goals.

The scenarios developed for this report are as follows:

1. Baseline: The Cost of Inaction. Progress in reduction of stunting and underweight child stops.

For the baseline, the progress of reduction of the prevalence of undernutrition stops at the levels achieved in 2014. It also assumes that the population growth would maintain the pace reported in the year of the analysis, hence increasing the number of undernourished children and the estimated cost. As this scenario is highly unlikely, its main purpose is to establish a baseline, to which any improvements in the nutritional situation are compared in order to determine the potential savings in economic costs.

2. Scenario #1: Cutting by half the prevalence of child undernutrition by 2025.

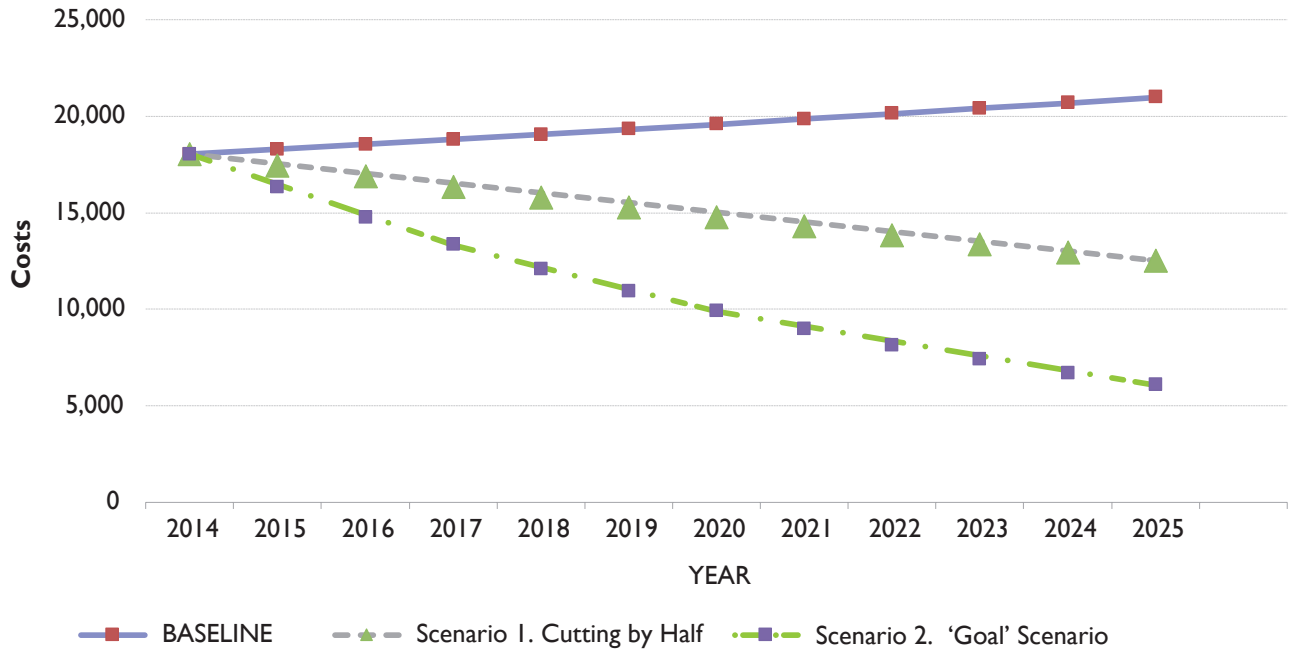
In this scenario, the prevalence of underweight and stunted children would be reduced to half of the 2014 values corresponding to the reference year. In the case of Sudan this would mean a constant reduction of 1.2 percent percent annually in the stunting rate from 38.2 percent (estimate for 2014) to 19.1 percent in 2025. A strong effort has to be carried-out to complete this scenario that would require a revision of the effectiveness of on-going interventions for the reduction of stunting as the average rate of reduction for stunting between 2005 and 2010 was estimated at 4.7 percent. This is however, an improvement from the previous measurement, where from the year 2000 to 2005, the average annual rate of progress in the reduction of stunting was only 0.3 percent.

3. Scenario #2: The 'Goal' Scenario. Reduce stunting to 10 percent and underweight children to 5 percent by 2025.

In this scenario, the prevalence of stunted children would be reduced to 10 percent and the prevalence of underweight children under the age of five, to 5 percent. Currently, the global stunting rate is estimated at 26 percent, with Africa having the highest prevalence at 36 percent. This Goal Scenario would require a true call for action and would represent an important regional challenge, in which countries of the region could collaborate jointly in its achievement. The progress rate required to achieve this scenario would be 4.7 percent annual reduction for a period of 12 years, from 2014 to 2025.

As shown in Figure 1.18, the progressive reduction of child undernutrition generates a similar reduction in the costs associated to it. The distances between the trend lines would indicate the savings that would be achieved in each scenario.

Figure 18: TRENDS OF ESTIMATED COSTS OF CHILD UNDERNUTRITION, 2009-2025 *(IN MILLIONS OF SDG)*



In the baseline, where the progress of reduction of child undernutrition would stop at the levels of 2014, the total cost would increase by 16 percent, from 18,043 to 20,985 billion SDG, during the period leading to 2025. Similarly, in the Scenario 1, in which a reduction by half of the current prevalence is achieved, the total cost would reduce by 31 percent to 12,504 billion SDG. In the case of the Goal Scenario on the other hand, there would be a 66 percent reduction in the estimated total costs, amounting to 6,084 billion SDG.

TABLE 15: ESTIMATED TOTAL COSTS OF CHILD UNDERNUTRITION, BY SCENARIO, 2014)
(IN MILLIONS OF SDG)

	2014	Baseline. The Cost of Inaction	Scenarios for the Year 2025	
			S1. Cutting by Half	S2. Goal Scenario
Heath Costs				
Increased Morbidity	7,778	9,040	4,913	2,037
Education Cost				
Increased Grade Repetition	271.5	325.9	212.4	150.5
Productivity Costs				
Lower Productivity in Non-Manual Activities	1,628	1,979	1,180	817
Lower Productivity in Manual Activities	821	967	546	311
Lower Productivity due to Mortality	7,545	8,673	5,652	2,767
Total Costs	18,043	20,985	12,504	6,084
Percentage Change from Baseline		16%	-31%	-66%

Source: Model estimations

The potential economic benefits of reducing undernutrition are a key element in making a case for nutrition investments.

The reduction in clinical cases in the health system, lowered grade repetition and improved educational performance as well as physical capacity are elements that contribute directly to the national productivity.

As presented in Table 14, cutting undernutrition by half by 2025 would represent a reduction in costs of over 30.31 billion SDG, equivalent to USD2.5 billion for the period of 11 years, from 2014 to 2025. Although the tendency of savings would not be linear, as they would increase over time with the achieved progress, a simple average of the annual savings would represent USD 344.79 million per year. In the case of the Goal Scenario, the savings would increase to 62.7 billion SDG, or USD 713.34 million, which represent a simple average of USD 59.44 million per year.

TABLE 16: ESTIMATED SAVINGS FOR EACH SCENARIO, 2014 *(IN MILLIONS OF SDG AND USD)*

		Cutting Undernutrition by Half by 2025		Goal Scenario 2025	
	SDG	USD	SDG	USD	
Heath Costs					
	Reduced Morbidity	14,715	167.37	28,300	321.9
Education Cost					
	Reduced Grade Repetition	454	5.16	734	8.35
Productivity Costs					
	Higher Productivity in Non-Manual Activities	3148	35.8	4,911	55.86
	Higher Productivity in Manual Activities	1,485	16.89	2,516	28.62
	Increased Working Hours	10,512	119.57	26,255	298.62
Total Savings		**30,314**	**5,254**	**62,717**	**10,871**
Average Annual Savings		2,526	437.8	5,226.4	905.96

Section V

Conclusions and Recommendations

Section V: Conclusion and Recommendations

5.1 The Conclusions

The Sudan's Transitional Government (STG) principles enshrined in the political agreement, the constitutional document for the interim period it will work tirelessly to establish the key features of a stable civilian and democratic State and realize its necessary economic and social revival. The Cost of Hunger in Sudan presents an opportunity to better understand the role that child nutrition can play as a catalyst for the achievement of interim period priorities.

The results of the COHA in Sudan strongly suggest that in order for the country to achieve sustainable human and economic growth, special attention must be given to the early stages of life as the foundation of human capital. The results of the study are supported by a strong evidenced base, and a model of analysis specially adapted for Africa, which demonstrates the depth of the consequences of child undernutrition in health education and labour productivity. This study further quantifies the potential gains of addressing child undernutrition as a priority. Now, stakeholders have not only the ethical imperative to address child nutrition as a main concern, but a strong economic rationale to position stunting in the centre of the development agenda.

From a health sector perspective, **the study estimates that child undernutrition generates health costs equivalent to 67.9 percent of the total public budget allocated to health.** These costs are due to episodes directly associated with the incremental quantity and intensity of illnesses that affect underweight children and the protocols necessary for their treatment. It is also important to note that almost only 1 out of every 3 children (29.9 percent) is estimated to be receiving proper health attention. As the health coverage expands to rural areas, there will be an increase of people seeking medical attention; this can potentially affect the efficiency of the system to provide proper care services. This study illustrates that a reduction of child undernutrition could facilitate the effectiveness of this expansion by reducing the incremental burden generated by the health requirements of underweight children.

Further, **the study estimates that 37.7 of all cases of child mortality are associated with the higher risk of undernutrition.** Hence, a preventive approach to undernutrition can help reduce this incremental burden to the public sector, and also reduce the costs that are currently being covered by caretakers and families. A reduction of child undernutrition will have a direct impact on increasing the life expectancy level.

Increasing the educational level of the population, and maximizing the productive capacity of the population dividend, is a key element to increase competitiveness and innovation. This represents a particular opportunity in Sudan where the population under 15 years is estimated to be 41% of the total population. These children and youth must be equipped with the skills necessary for competitive labour. Thus, the underlying causes for low school performance and early desertion must be addressed. As there is no single cause for this phenomenon, a comprehensive strategy that considers improving in the quality of education and the conditions required for school attendance must be put in place. This study demonstrates that stunting is one barrier to attendance and retention, and to effectively elevate the educational levels and improve individuals' labour opportunities in the future, this barrier must be removed.

The study estimated that children who were stunted experienced a 5.4 percent higher repetition rate in school. As a result, 28.9 percent of all grade repetitions in school were associated to the higher incidence of repetition that is experienced by stunted children. The largest proportion of these grade repartitions occur in primary school, suggesting that a reduction in the stunting prevalence could also support an improvement in schooling results, as it would reduce preventable burdens to the education system. A reduction in the prevalence of stunted children can have an impact in improving performance, grade retention, hence enrolment and transitions rates.

By preventing child stunting thus avoiding the associated loss in physical and cognitive capacity that hinders individual productivity, people can be provided with a more equal opportunity for success. **The study estimates that 45.7 percent of the current working age population in Sudan suffered from stunting as a child.** This population has achieved on average, lower schooling levels than those who did not experience growth retardation of 1.0 years of lower schooling.

The COHA model also provides an important prospective analysis that sheds light on the potential economic benefits to be generated by a reduction in the prevalence of child undernutrition. **The model estimates that a reduction of the prevalence to half of the current levels of child undernutrition by the year 2025 can generate annual average savings of SDG 2.5 billion (USD 437.8 million).** An additional scenario shows that **a reduction to 10% stunting and 5 % underweight for that same period could yield annual average savings of SDG 5.2 billion (USD906 million).** This economic benefit that would result from a decrease in morbidities, lower repetition rates and an increase in manual and non-manual productivity, presents an important economic argument for the incremental investments in child nutrition.

5.2 Recommendations towards eradicating child undernutrition

1. A clear recommendation of this study is that **Sudan must review their national development frameworks to ensure that the reduction of the stunting prevalence is an outcome indicator of their social and economic development policies.** Chronic child undernutrition can no longer be considered a sectoral issue, as both its causes and solutions are linked to social policies across numerous sectors. As such, stunting reduction will require interventions from the health, education, social protection, and social infrastructure perspectives. Stunting can be an effective indicator of success in larger social programs.

2. The results of this study encourage Sudan not to be content with "acceptable" levels of stunting; equal opportunity should be the aspiration of every country on the continent. In this sense, it is **recommended that ambitious targets are set in Sudan the reduction of stunting that go beyond proportional reduction, to establish an absolute value as the goal at 10%.** More specifically, **investment should be increased in combating undernutrition during the first 1000 days of a child's life,** including through improved availability and access to nutrient-dense complementary foods for children aged 6 to 23 months old.

3. The right policy environment is critical in addressing the multiple dimensions of child nutrition. It is **recommended that Sudan puts in place a comprehensive multisectoral nutrition policy, strategy and plan of action, with strong political commitment and allocation of adequate resources for its implementation across all line ministries.** These documents should look to identify and take action on which drivers determine the current state of child undernutrition in order to adequately shape and ensure effective programmes that address child undernutrition. These may include a lack of production, awareness, quality, availability, sanitation, fortification, social protection, water, family dynamics etc. Furthermore, it is recommended that the assessment of child nutrition also includes information that relates the nutritional status of the children to the livelihoods and economic activities of the households. This information can be used to ensure that interventions effectively reach these vulnerable families with appropriate incentives and innovative approaches within social protection schemes.

4. **Promote the delivery of nutrition services integrated with other essential services:** The government of Sudan has in place maternal child health such as ANC, PNC and growth monitoring services provided through the health delivery system. While these are directed to ensure healthy pregnancies and good birth outcomes while promoting positive health behaviour, the utilization is still limited. Because of this reason, nutrition services delivery at health facility level is low. Therefore **utilization of essential health services should be increased and nutrition services should be delivered at all contact points.**

5. **Promote optimal complementary feeding practices:** Though there is some improvement in breast feeding practice in the country, the level of appropriate complementary feeding practices is still very low. **Therefore, it is recommended that best practices observed in some area regarding improving the complementary feeding practice, through improved local food processing should be scaled up and interventions should be employed to enrich food with micronutrients.**

6. Sudan is challenged with significant levels of micronutrient deficiencies impacting all population groups. With limited consumption of a balanced diet by most of the population, dietary diversity remains a challenge. Therefore, **it is recommended that mandatory fortification of staple foods (flour, oil, salt) with multiple micronutrients should be initiated and scaled up.**

7. A priority area for enhancing the national capacity to address malnutrition is **to improve monitoring and evaluation systems and clearly link these to prevention interventions.** Currently, assessments of the prevalence of child nutrition are carried-out periodically, every 5 years. Nevertheless, in order to be able to measure short term results in the prevention of stunting, a more systematic approach with shorter periodicity is recommended, of 2 years between each assessment. As the focus on the prevention of child undernutrition should target children under 2 years of age, these results will provide information to policy makers and practitioners on the results being achieved in the implementation of social protection and nutrition programmes. In practical terms, this may be achieved by strengthening a national nutrition surveillance system that facilitates evidence-based interventions and is complemented by ensuring that the effectiveness of preventative interventions is adequately evaluated.

8. **Schools can also serve as good platform for behaviour change communication for future generations through nutrition and health education, as well as for health check-ups and screening.** Nutritional awareness materials can be introduced into the school curriculum, while strengthening health and nutrition training for teachers will be key to delivering this. More specifically, targeting school girls in this area is critical, as those girls will be future mothers and shall bear much of the responsibility of raising a family and overseeing feeding practices for them. Additionally, periodic check-ups and screening by health professionals on the nutritional status of children in schools, particularly for anaemia, can also help determine the effectiveness of the interventions and the need to adjust activities. The school feeding programme overseen by the Ministry of Education that currently reaches 1.2 million of an estimated 6 million students, serves as a good incentive for school enrolment and retention, as well as a safety net in food insecure communities.

9. **Increase awareness and advocacy of key stakeholders at all levels on the social and economic impacts of child under nutrition to ensure that nutrition, with a focus on addressing stunting, receives the highest possible level of commitments.** The results of the COHA study could provide a strong base for guiding policies and enhancing advocacy, resource mobilization and political leverage on nutrition.


18 19 20 21 22 23 24 25 26

Section VI

Annexes

Section VI: Annexes

Annex 1 Glossary of Terms

1. **Average number of days required for hospitalization:** The average number of days a child needs to stay in a hospital when hospitalized, to receive adequate care.

2. **Average number of days required for Intensive Care Unit (ICU):** The average number of days a child needs to stay in the ICU when put in ICU care, to receive adequate care.

3. **Average number of primary care visits per episode:** When a child experiences a given pathology, he/she may require medical care multiple times. This variable is the average number of primary (outpatient) medical care visits a child requires per episode.

4. **Average waiting time spent at primary care:** When a caretaker brings a child to a primary care facility, the time the parent and child spend at the facility for waiting and receiving care.

5. **Cost of medical inputs per event during hospitalization:** This variable includes the medical materials (medicines, procedures) that are covered by the hospital for treatment of each pathology case.

6. **Cost of medical inputs per event in ICU:** This variable includes the medical materials (medicines, procedures) that are covered by the hospital for treatment of each pathology case in ICU.

7. **Cost of medical inputs per event in primary care:** This variable includes the medical materials (medicines, procedures) that are covered by the health facility for treatment of each pathology case.

8. **Costs not covered by the health system:** This variable includes the value of the inputs (i.e. medications) that are paid for by the family.

9. **Daily cost of hospital bed during hospitalization:** This variable includes the total cost to the hospital calculated per day per patient staying in the hospital. This value includes the cost of staff, facilities and equipment, as a unit cost per patient.

10. **Daily cost of hospital bed in ICU:** This variable includes the total cost to the hospital calculated per day per patient staying in the ICU. This value includes the cost of staff, facilities and equipment, as a unit cost per patient.

11. **Daily hours lost due to hospitalization:** The number of hours the caretaker spends at the hospital each day with the child when he/she brings a child to a primary care facility.

12. **Differential Probability (DP):** Refers to the difference between the probability of occurrence of a consequence (i.e., disease, grade repetition and lower productivity) given a specific condition. The model uses this variable specifically to determine the risk among those suffering from undernutrition and those who are not Economic Commission of Latin America Countries (ECLAC).

13. **Discount rate:** The interest rate used to assess a present value of a future value by discounting (FAO). In the model it is utilized to obtain the present value in the scenario section.

14. **Dropout rate per grade:** Percentage of students who drop out of a grade in a given school year (UNESCO).

15. **Episodes:** It is the number of disease events occurring for a given pathology. In the model it is based on a 1year period, i.e. the number of times a specific pathology occurs in 1 year (ECLAC).

16. **Food insecurity:** Exists when people lack access to sufficient amount of safe and nutritious food and therefore, are not consuming enough for an active and healthy life. This may be due to the unavailability of food, inadequate purchasing power or inappropriate utilization at household level (FAO).

17. **17.Food vulnerability:** Reflects the probability of an acute decline in food access or consumption, often in reference to some critical value that defines minimum levels of human wellbeing World Food Programme (WFP).

18. **Hunger:** The status of persons, whose food intake regularly provides less than their minimum energy requirements, i.e. about 1,800 kcal per day. It is operationally expressed by the undernourishment indicator (FAO).

19. **Incidental retrospective dimension:** Used to estimate the cost of undernutrition in a country's population in a given year. The model applies it by looking at the health costs of pre-school children (0 to 5-year-olds) suffering from undernutrition, the education costs of school-age children (6 to 18-year-olds) and the economic costs resulting from lost productivity by working-age individuals (15 to 64-year-olds) (ECLAC).

20. **Intrauterine growth restriction (IUGR):** Refers to the foetal weight that is below the 10th percentile for gestational age (WHO). In the model, this is the only type of condition considered in the estimation of cost for low birth weight children.

21. **Low Birth Weight (LBW):** A new-born is considered to have low birth weight when he/she weighs less than 2,500 grams (WHO).

22. **Malnutrition:** A broad term for a range of conditions that hinder good health caused by inadequate or unbalanced food intake or by poor absorption of the food consumed. It refers to both undernutrition (food deprivation) and over nutrition (excessive food intake in relation to energy requirements) (FAO).

23. **Mortality rate:** The proportion of deaths per year in a given population, usually multiplied by a 10th population size so it is expressed as the number per 1,000, 10,000, 100,000, individuals per year.

24. **Percentage of cases that attend health services:** The proportion of episodes for which a caretaker brings a child to a primary health facility for treatment.

25. **Private costs**

26. **Productivity/Labour productivity:** Measures the amount of goods and services produced by each member of the labour force or the output per unit of labour (ILO). In the model, it refers to the average contribution that an individual can make to the economy, measured by consumption or income, depending on data availability.

27. **Proportion of episodes requiring hospitalization:** When a child experiences pathology, he/she may require in-patient care. This variable identifies the proportion of the episodes by pathology, for which a child requires hospitalization.

28. **Proportion of episodes requiring ICU:** When a child experiences pathology, he/she may require care in an ICU facility. This variable identifies the proportion of the episodes by pathology, for which a child requires ICU care.

29. **Prospective or potential savings dimension:** This dimension makes it possible to project the present and future losses incurred as a result of medical treatment, repetition of grades in school and lower productivity caused by undernutrition among children under the age of five in each country, in a specific year (ECLAC).

30. **Public social spending:** Social expenditure is the provision by public (and private) institutions of benefits to, and financial contributions targeted at, households and individuals in order to provide support during circumstances, which adversely affect their welfare, provided that the provision of the benefits and financial contributions constitutes neither a direct payment for a particular good or service nor an individual contract or transfer (OECD).

31. **Relative risk:** Refers to the risk of an event occurring, given a specific condition. It is expressed as a ratio of the probability of the event occurring in the exposed group versus a non-exposed group. In the model it is used to establish the risk level of disease, lower educational performance or lower productivity relative to exposure to undernutrition.

32. **Repetition rate per grade:** Number of repeaters in a given grade in a given school year, expressed as a percentage of enrolment in that grade in the previous school year (UNESCO).

33. **Stunting:** Reflects shortness-for-age; an indicator of chronic malnutrition, calculated by comparing the height-for-age of a child with a reference population of well-nourished and healthy children (WFP). The model uses it as the indicator to analyse the impact on educational performance and productivity.

34. **Survival rate:** A rate calculated for a given geographic area that presents the likelihood of a person surviving in a given period of time.

35. **Undernourishment:** Food intake that is continuously insufficient to meet dietary energy requirements. This term is used interchangeably with chronic hunger, or, in this report, hunger (FAO).

36. **Undernutrition:** The result of prolonged low levels of food intake and/or low absorption of food consumed (undernourishment). It is generally applied to energy (or protein and energy) deficiency, but it may also relate to vitamin and mineral deficiencies (FAO).

37. **Underweight:** Measured by comparing the weight-for-age of a child with a reference population of well-nourished and healthy children (WFP). The model utilizes it to analyse the impact of child undernutrition on health.

38. **Unit cost per attention in primary care:** This variable includes the total cost to the health facility per attention, comprising the cost of staff, facilities and equipment, as a unit cost per patient.

39. **Wasting:** Reflects a recent and severe process that led to substantial weight loss, usually associated with starvation and/or disease. Wasting is calculated by comparing weight-for-height of a child with a reference population of well-nourished and healthy children (WFP).

Annex 2 Technical Notes on Methods and Assumptions

Index	Source
First Economic Data	
Gross Domestic Product	International monetary fund data for 2014. Central Bureau of Statistics
USD exchange rate	International monetary fund data for 2014. Central Bank of Sudan, https://cbos.gov.sd › exchange-rates
Purchasing power parity	Central Bank of Sudan
Social Expenditure	Ministry of finance and economic planning Ministry of Social welfare and Development Federal Governance Chamber
Health Expenditure	Federal Ministry of Health, Health Accounts 2013, 2015
Education Expenditure	Ministry of Education; Education Cost in Sudan Survey
Average transport cost (two ways public transportation tickets in urban areas in local currency)	Sudan Household Health Utilization and Expenditure Survey.
Minimum wage per hour	Ministry of Labor, Personnel Affairs Bureau
Average wage per hour	Ministry of Labor, Personnel Affairs Bureau
Annual Consumer price index	Central Bureau of Statistics
Average income per years of schooling	Computations from the Sudan Labor Force Survey 2011
Annual average income related to productive work, manual intensive activities (Agriculture, Forestry, Fishery, Mining) by age	Computations from the Sudan Labor Force Survey 2011
Annual average income related to productive work, NON manual intensive activities (Excluding Agriculture, Forestry, Fishery, Mining) per years of schooling and age	Computations from the Sudan Labor Force Survey 2011
Average working hours per week	Ministry of Labor Sudan Labour Act
Annual worked hours per age group	Ministry of Labor Sudan Labour Act
Employment rate	Computations from the Sudan Labor Force Survey 2011
Second Demographic Data	
Volume of Births	Central Bureau of Statistics
Death rate	Central Bureau of Statistics
Distribution of workers by Manual and Non-Manual Labour per age group	Computations from the Sudan Labor Force Survey 2011
Distribution of workers by educational status	Computations from the Sudan Labor Force Survey 2011
Working age population (WAP) by educational level	Computations from the Sudan Labor Force Survey 2011

Index	Source
Third Health Data	
Underweight prevalence for the year of analysis or last available.	MICS 2014
Stunting prevalence for the year of analysis or last available.	MICS 2014
Underweight prevalence of children under 5 years old	MICS 2014
Underweight mode prevalence	MICS 2014
Stunting prevalence of children under 5 years old	MICS 2014
Stunting mode prevalence	MICS 2014
Number of annual disease events (anaemia, ADS, ARI, Stunting, Underweight, Wasting) by Age group	MICS 2014 Sudan Malaria Survey 2016 Sudan Household Health Utilization and Expenditure Survey 2012
Average number of primary care visits for each pathology (anaemia, ADS, ARI, Stunting, Underweight, Wasting) by Age group	MICS 2014 Sudan Malaria Survey 2016 Sudan Household Health Utilization and Expenditure Survey 2012
Proportion of events of pathology (anaemia, ADS, ARI, Stunting, Underweight, Wasting) by Age group requiring hospitalization	MICS 2014 Sudan Malaria Survey 2016 Sudan Household Health Utilization and Expenditure Survey 2012
Average number of days of hospital treatment for each event (anaemia, ADS, ARI, Stunting, Underweight, Wasting) by Age group	MICS 2014 Sudan Malaria Survey 2016 Sudan Household Health Utilization and Expenditure Survey 2012
Proportion of events of pathology (anaemia, ADS, ARI, Stunting, Underweight, Wasting) by Age group requiring intensive treatment (ICU)	MICS 2014 Sudan Malaria Survey 2016 Sudan Household Health Utilization and Expenditure Survey 2012
Average number of days of intensive treatment UTI / UCI for each event (anaemia, ADS, ARI, Stunting, Underweight, Wasting) by Age group	Annual Statistical Report, FMOH, 2018
Average waiting time spent at primary care attention (anaemia, ADS, ARI, Stunting, Underweight, Wasting) by Age group	MICS 2014 Sudan Malaria Survey 2016 Sudan Household Health Utilization and Expenditure Survey 2012
Daily hours lost due to hospitalization (anaemia, ADS, ARI, Stunting, Underweight, Wasting) by Age group	MICS 2014 Sudan Malaria Survey 2016 Sudan Household Health Utilization and Expenditure Survey 2012

Index	Source
Average unit cost for attention in primary care by age group and pathology (anaemia, ADS, ARI, Stunting, Underweight, Wasting), for the year of analysis (x) in local currency,	Estimated by health specialists and health economists through in-depth interview. Ahmed Gasim Pediatric Hospital and Omdurman Pediatric Hospital 2018 Costs includes extra cost of care borne by the family, HHUES 2012 Calculation of health cost includes; Consultation fee, cost of bed, cost of laboratory tests, cost of drugs as per FMOH standard case management protocol, Central Medical Supply Fund Drug Price List 2018
Average cost of medical inputs for event in primary care by age group and pathology (anaemia, ADS, ARI, Stunting, Underweight, Wasting), for the year of analysis (x) in local currency,	Estimated by health specialists and health economists through in-depth interview. Ahmed Gasim Pediatric Hospital and Omdurman Pediatric Hospital 2018 Costs includes extra cost of care borne by the family, HHUES 2012 Calculation of health cost includes; Consultation fee, cost of bed, cost of laboratory tests, cost of drugs as per FMOH standard case management protocol, Central Medical Supply Fund Drug Price List 2018
Average unit cost for attention in hospital by age group and pathology (anaemia, ADS, ARI, Stunting, Underweight, Wasting), for the year of analysis (x) in local currency,	Estimated by health specialists and health economists through in-depth interview. Ahmed Gasim Pediatric Hospital and Omdurman Pediatric Hospital 2018 Costs includes extra cost of care borne by the family, HHUES 2012 Calculation of health cost includes; Consultation fee, cost of bed, cost of laboratory tests, cost of drugs as per FMOH standard case management protocol, Central Medical Supply Fund Drug Price List 2018
Average cost of medical inputs for event in hospital by age group and pathology (anaemia, ADS, ARI, Stunting, Underweight, Wasting), for the year of analysis (x) in local currency,	Estimated by health specialists and health economists through in-depth interview. Ahmed Gasim Pediatric Hospital and Omdurman Pediatric Hospital 2018 Costs includes extra cost of care borne by the family, HHUES 2012 Calculation of health cost includes; Consultation fee, cost of bed, cost of laboratory tests, cost of drugs as per FMOH standard case management protocol, Central Medical Supply Fund Drug Price List 2018
Average unit cost for attention in hospital intensive care unit by age group and pathology (anaemia, ADS, ARI, Stunting, Underweight, Wasting), for the year of analysis (x) in local currency,	Estimated by health specialists and health economists through in-depth interview. Ahmed Gasim Pediatric Hospital and Omdurman Pediatric Hospital 2018 Costs includes extra cost of care borne by the family, HHUES 2012 Calculation of health cost includes; Consultation fee, cost of bed, cost of laboratory tests, cost of drugs as per FMOH standard case management protocol, Central Medical Supply Fund Drug Price List 2018.

Index	Source
Average unit private cost by age group and pathology (anaemia, ADS, ARI, Stunting, Underweight, Wasting), for the year of analysis (x) in local currency,	Estimated by health specialists and health economists through in-depth interview. Ahmed Gasim Pediatric Hospital and Omdurman Pediatric Hospital 2018 Costs includes extra cost of care borne by the family, HHUES 2012 Calculation of health cost includes; Consultation fee, cost of bed, cost of laboratory tests, cost of drugs as per FMOH standard case management protocol, Central Medical Supply Fund Drug Price List 2018
Average private cost of medical inputs for event by age group and pathology (anaemia, ADS, ARI, Stunting, Underweight, Wasting), for the year of analysis (x) in local currency,	Estimated by health specialists and health economists through in-depth interview. Ahmed Gasim Pediatric Hospital and Omdurman Pediatric Hospital 2018 Costs includes extra cost of care borne by the family, HHUES 2012 Calculation of health cost includes; Consultation fee, cost of bed, cost of laboratory tests, cost of drugs as per FMOH standard case management protocol, Central Medical Supply Fund Drug Price List 2018
Percentage of low birth weight children	MICS 2014
Proportion of events of LBW requiring/access hospitalization	FMOH, Guidelines for LBW management
Average number of days of hospital treatment	Estimated by health specialists and health economists through in-depth interview. Ahmed Gasim Pediatric Hospital and Omdurman Pediatric Hospital 2018
Proportion of events of LBW requiring intensive treatment UTI / UCI	FMOH, Guidelines for LBW management
Average number of days of intensive treatment	Estimated by health specialists and health economists through in-depth interview. Ahmed Gasim Pediatric Hospital and Omdurman Pediatric Hospital 2018
Average waiting time (in hours) spent by an adult accompanying a child patient requiring hospitalization	Sudan Household Health Utilization and Expenditure Survey 2012
Education Data	
Initial enrolment by years of education	Data were obtained from Ministry of Education.
Final enrolment by years of education	Data were obtained from Ministry of Education.
Number of passes by years of education	Data were obtained from Ministry of Education.
Number of dropouts (rate) by years of education	Data were obtained from Ministry of Education.
Number of populations repeating grades (rate) by years of education	Data were obtained from Ministry of Education.
Private cost per student / year by educational grade	Sudan Cost of Education Survey 2011
Total Number of students year 2009	Ministry of Education, Statistical Yearbook.
Public cost per student	Sudan Cost of Education Survey 2011
Morbidity differential probability for anaemia among healthy versus underweight children by age groups.	MICS 2014

Index	Source
Morbidity differential probability for ADS among healthy versus underweight children by age groups.	MICS 2014
Morbidity differential probability for ARI among healthy versus underweight children by age groups.	MICS 2014
Morbidity differential probability for anaemia among healthy versus stunted children by age groups.	MICS 2014
Morbidity differential probability for ADS among healthy versus stunted children by age groups.	MICS 2014
Morbidity differential probability for ARI among healthy versus stunted children by age groups.	MICS 2014.
Probability ratio of death between those who suffered from undernutrition	MICS 2014
Probability ratio of death between those who suffered from stunting.	MICS 2014
Higher Probability (relative risk) of stunted of repeating grades.	MICS 2014
Higher Probability (relative risk) of stunted of dropping out.	Calculated from Education Statistics Data 2014.
Monthly hours worked.	Ministry of Labour.
Average travel time for ambulatory care.	HHUES 2012

Annex 3 Overview of the COHA Model

The model for the COHA study represents a step forward in estimating the social and economic consequences of child undernutrition in Africa. Several national and regional efforts have been implemented to assess the costs of undernutrition globally and in the region. Notable initiatives at the regional level include those led by ECLAC, carried out jointly with WFP in Latin America and the Caribbean (LAC) and the PROFILES initiatives[65] which developed similar country-level estimations in selected countries worldwide. The COHA, however, represents the only effort constructed for the African continent, involving nutrition experts from the continent, who provided recommendations during the adaptation process, with critical support of country teams. The model developed by ECLAC to estimate the social and economic consequences on child undernutrition in LAC[66] presented the most appropriate base to develop a model for Africa. In the development of the model for LAC, the authors focused on the consequences of child undernutrition from a life-cycle approach, avoiding the potential overlaps with other nutritional deficiencies. This approach proved to be an important political instrument to mobilize stakeholders around nutrition in LAC and was considered by many to be state-of-the-art knowledge in this field.

The development of the COHA model proved to be a good practice of South-South collaboration between two regional UN Economic Commissions. ECLAC, AUC and WFP Africa office worked together in a series of joint technical activities and consultations to transfer knowledge and generate the adjustments for the development of the new model to Africa. An interdivisional working group was created within ECA that included the African Centre for Statistics, the African Centre for Gender and Social Development, the Economic Development and NEPAD Division of the ECA as well as a number of UN partners, namely WFP, UNICEF, the International Labour Organization (ILO) and WHO – to ensure multidisciplinary contributions in the development of the model.

At the regional level, the technical validation of the COHA model was provided by the African Task Force for Food and Nutrition Development (ATFFND). The Task Force, which brings together regional nutrition experts and practitioners, was the ideal body to provide guidance in the development of the model. In consecutive meetings, the ATFFND provided key recommendations, thus laying out a roadmap for the adaptation process, and finally expressed its satisfaction with the proposed COHA model.

Adapting the COHA process

To facilitate the implementation of the project, leadership roles were identified: the AUC Department of Social Affairs and the NEPAD Planning and Coordinating Agency led the initiative; ECA/ECLAC coordinated its implementation, while WFP and other partners supported the capacity building process, both at regional and country levels. Further, the following governing structures were established:

1. The Steering Committee/ATFFND: The high-level Steering Committee is chaired by the AUC. The Steering Committee is charged with convening partner organizations, approving the study design and action plan and overseeing the implementation of the study and dissemination of results. The Steering Committee also provides political support to the initiative.

2. The Regional Secretariat: The Regional Secretariat, based at WFP Africa office, worked through a small technical team, drawn from NEPAD, AUC, WFP, ECLAC and other relevant organizations, to support the preparation, implementation and dissemination of the study, as well as to facilitate smooth and quality work of the national implementation teams and expert committees. The Secretariat reported to the Steering Committee and executed the study budget.

65 13 "FHI 360 Profiles," FHI 360 Profiles, accessed September 27, 2013, http://fhi360profiles.org/.

66 Rodrigo Martínez and Andrés Fernández, Model for Analysing the Social and Economic Impact of Child Undernutrition in Latin America (Santiago de Chile: Naciones Unidas, CEPAL, Social Development Division, 2007).

3. The National Implementation Team (NIT): The core implementation of the study was carried out by a national team in each participating country, drawn from relevant governmental institutions, such as the Ministry of Health, Ministry of Education, Ministry of Social Development, Ministry of Planning, Ministry of Finance and the National Statistics Institution. In certain situations, a broader reference group was also created to include other actors and United Nations agencies, such as WFP, UNICEF and WHO. The WFP country offices facilitated the process according to specific country situations and supported coordination of the NIT as required.

For the initial phase of the project, a number of criteria were agreed upon to select the initial countries. The requirements were as follows:

1. Data availability: The availability of at least two recent, nationally representative survey datasets on fertility, family planning, maternal and child health, gender, malaria and nutrition, preferably the Demographic and Health Survey (DHS).
2. Sub-regional coverage: At least one country selected from each AU region: Community of Sahel-Saharan States (CEN-SAD), Common Market for Eastern and Southern Africa (COMESA), Economic Community of Central African States (ECCAS), Economic Community of Western African States (ECOWAS), Intergovernmental Authority for Development (IGAD), Southern African Development Community (SADC) and Union du Maghreb Arabe (UMA). Overlapping membership to various Regional Economic Communities was also taken into account in the final selection of countries.
3. Socio-economic representation: Prevalence of poverty and under-nourishment in the overall population and occurrence of episodes of drought or other natural disasters.
4. Existence of a national platform on malnutrition and hunger.

Based on these criteria, 12 initial countries were selected. 8 of these countries, namely Egypt, Ethiopia, Swaziland Uganda, Burkina Faso, Ghana, Malawi, and Rwanda have completed the study. Beyond the initial selection of countries studied, the study has been completed in Chad, Madagascar, Lesotho and the Democratic Republic of Congo.

VII Section

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